THE BULLETIN
OF THE
AMERICAN CERAMIC SOCIETY

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TO THE PROMOTION OF CERAMIC
EDUCATION AND TECHNOLOGY

JANUARY • 1934

VOLUME 13 NUMBER 1

ESTABLISHED 1869

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THE BULLETIN

of the
AMERICAN CERAMIC SOCIETY

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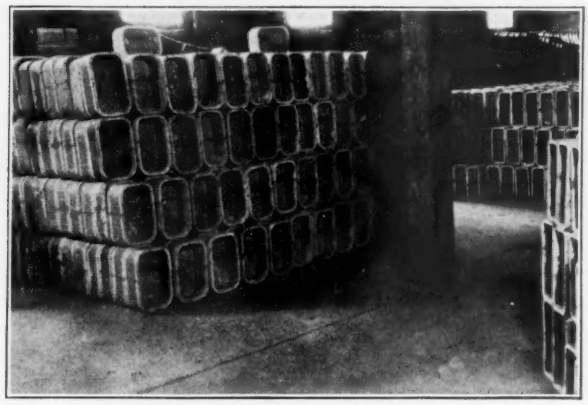

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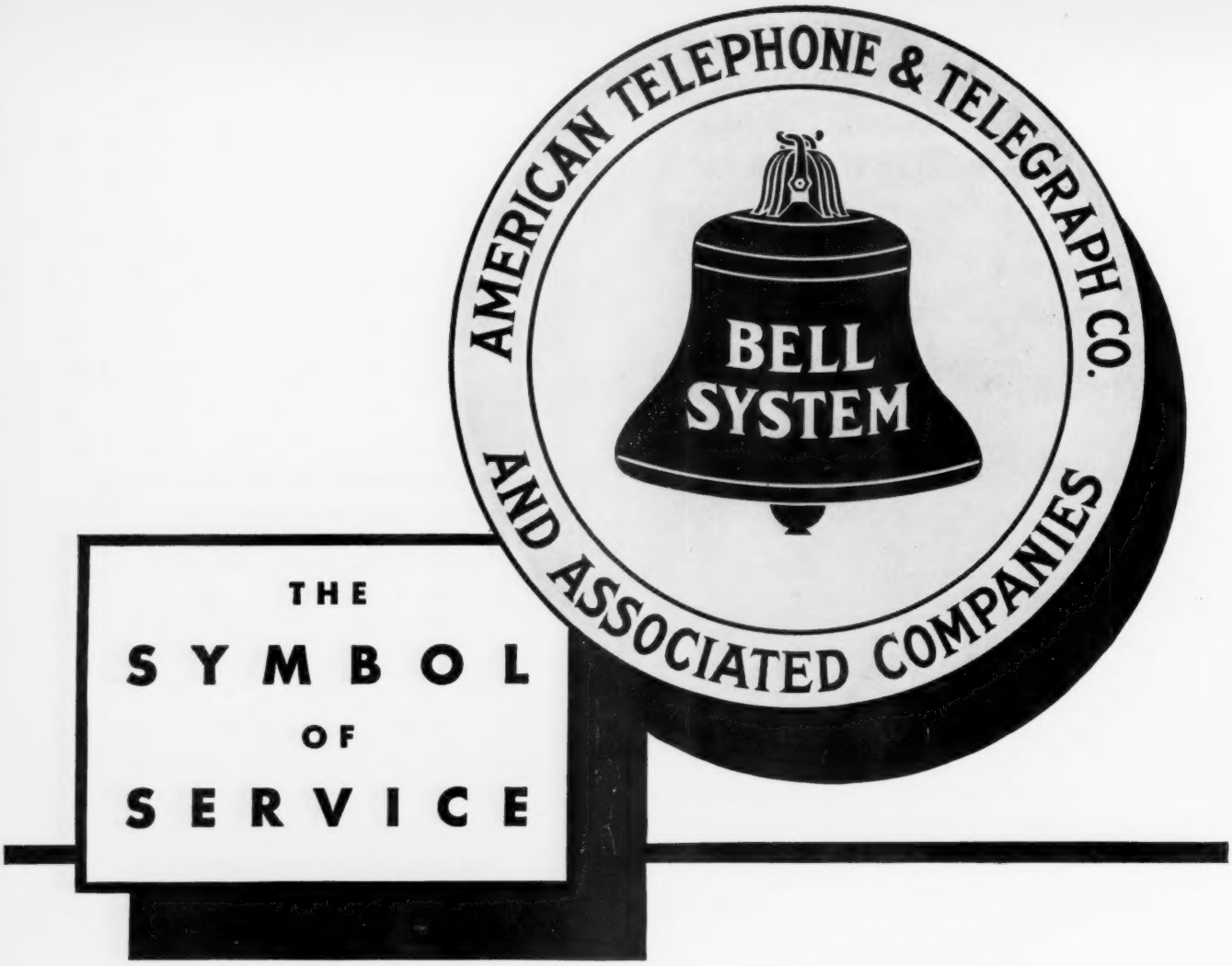

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THE BULLETIN

of the American Ceramic Society

A Monthly Publication Devoted to Proceedings
of the Society and Promotion of Coöperative Research
of Technical, Scientific, and Art Questions

Vol. 13 January, 1934 No. 1

EDITORIALS

"LAND OF THE SPREE AND HOME OF THE CRAVE"

All lands, prior to 1929, were on a spending and craving spree which catapulted many of them into the World War and caused most of them, even during the post-war years, to spend beyond their ability to repay.

As with countries so it was with men. Gigantic and elaborate buildings were erected; extraordinary activity programs for clubs, churches, schools, civic organizations, and families were planned; even scientific and technical societies went on spending sprees and dreamed of larger facilities and activities.

As a result of these excesses and in ratio thereto, the currencies of all countries became inflated. The gold values of savings, investments, and wages decreased 50% or more in most of the countries.

The American Ceramic Society did not increase salaries when industrial and professional salaries were increased during the post-war inflation period. The Society's equipment and inventory were kept to a minimum actually and in book value. Conservatism has been practiced in all things except in rendering service to its members. This desire to render service should not be abated but it must be restrained in ratio to the Society's financial resources.

It has been found that the demand for the service which the Society is rendering is proportionate, not with amount and character of the service rendered as much as it is with the extent to which it is sold to those whom the service is benefiting. It is a human characteristic not to give support voluntarily to organized civic, cultural, patriotic, political, fraternal, and religious or educational institutions no matter how valuable their rendered services may be. People do not "join" except when solicited or unless there is an ambitious motive; and ambitious motives must be created.

The American Ceramic Society will continue to serve only to the extent that its services are sold by personal solicitations; merit or service value alone will not bring the needed support.

There is no ceramic organization or person who is not benefited by the activities of the American Ceramic Society. The reports of original research, the abstracts of the world's literature, the promotional activities of its committees, and its meetings have very directly caused advancement of the ceramic arts, science, and technology, putting ceramic corporations in a position to meet more satisfactorily the present-day conditions of high wages and exacting product specifications. The direct result of the activities of the American Ceramic Society are translated and transmitted through various means to the plant operators and workers. The benefits of the activities of the American Ceramic Society reach every ceramic corporation and person whether or not they are members of the Society. That these benefits are proportionate to the ability of this Society to render service is axiomatic but will be realized by ceramic corporations and persons only if these facts are personally presented to them.

The value and use of knowledge can not be inflated. With money values decreasing, it is increasingly imperative that more extensive studies shall be made of materials and the most effective methods of producing and using ware.

Technological sprees are beneficial. The craving for knowledge should be more intensive today than at any previous time. "Win with Wisdom."

Those who have had their minds and time monopolized by code preparations and those who have responsibilities of preserving trade effectiveness under threats of controlled market sharing and increased wage payments without product price control have little if any inclina-

tion, unless prompted to do so, to consider the benefits or the need of financing this, their most effective agency for promoting work pertaining to fundamental and applied technical ceramic knowledge. The cost to industrial concerns of code preparation, especially to those who have so varied their products as to be involved in several trade groups, has been excessive. Until business recovers sufficiently and until the new order of business procedure is in full swing it will be difficult to secure adequate support for the American Ceramic Society activities. This situation, however, should be a challenge—not a defeat.

The land that develops most largely its craving for fundamental and applied technical information will profit most largely. This is one "spree" that is necessary to keep the factory fires burning.

CURRICULA FOR UNDERGRADUATES

Work in Ceramics

It is rumored that (1) a special committee has been appointed by the Dean of the Engineering College of Ohio State University to consider the altering of the curriculum to make possible the incorporation of more hours of general educational (cultural) subjects, and (2) because the subjects as taught in the departments of mathematics and chemistry, respectively, do not give the training required by engineers, the committee is considering the substitution of cultural studies in part for the mathematics and chemistry. Rumor also has it that engineering drawing has been reduced in hours required in some of the engineering courses to give more time to special applied subjects. These rumors have been, in part, confirmed by the Dean.

The Dean further states that most curricula of engineering colleges give less time to mathematics, physics, and chemistry than do those at Ohio State University.

There is no doubt that engineering undergraduates could devote, with some profit, more time to languages, history, economics, or what comprises the so-called cultural subjects. Of more importance, it would seem, is the broadest possible ground work—the rudiments or the fundamentals of engineering.

This brings up the question of (1) the value of fundamentals in contrast with applied subjects and (2) the value of lectures based on literature reviews *vs.* original studies by the students under the direction of instructors in which they obtain first-hand knowledge and practice in the application of fundamentals to special engineering problems as given by the specialized engineering departments in the College of Engineering. If students have the opportunity to learn how to use the scientific instruments and methods in the production and testing of products with which they will work after graduation, thereby learning how product properties are produced and determined and the relative values of these in terms of the service to be rendered by the products, obtaining incidentally and from general reading the facts concerning materials and compositions, they will be well equipped as engineers and technologists.

Qualifications of The American Ceramic Society to Discuss Curricula

(1) The American Ceramic Society, like all technical societies, is educational in its concept and performance. This Society, for thirty-five years, has promoted ceramic education and research. It has suggested and has successfully promoted ceramic research in colleges, bureaus, and institutes.

(2) The American Ceramic Society is exclusively devoted to the promotion of the ceramic arts and science in the interest of ceramic industries, and thus it is within the scope of the Society to consider what preparation the ceramic school graduates should receive for engineering and technical service in the ceramic industries.

(3) The cash cost of collegiate training is paid largely by the industries and it is by the industries that the graduating engineers are employed. The ceramic industries through this Society therefore have a decided interest in the ceramic curricula of our schools. The university is not the sole party interested.

(4) Having operated for thirty-five years during which twenty or more colleges have established courses in ceramic engineering, the

American Ceramic Society should reflect the benefits of specialized and general collegiate preparation for service in ceramics.

Some pertinent facts are as follows: (*a*) Of the thirty-five presidents of this Society, twelve (34.2%) of them were ceramic graduates, ten (28.5%) majored in the fundamental sciences, five (14.25%) were business executives, and three (8.6%) geologists, the remaining five being two practical potters, two metallurgists, and one with a classical education.

(*b*) Of the last ten presidents only two (20%) of them had collegiate ceramic training, whereas five (50%) were trained as physicists and chemists.

(*c*) Of the last five presidents of the American Ceramic Society not one had training in a collegiate ceramic department, whereas three of them had, as collegiate students, majored in chemistry and physics. The nominee for president this year was graduated as an electrical engineer.

(*d*) Of the present twelve members of the Board of Trustees of this Society, nine are college graduates and only two of them from a ceramic course. Of the six new nominees for officers and trustees this year five are college degree men but only one is a graduate in ceramics.

(*e*) Of the Fellows of the American Ceramic Society now living (total 154) seventy-two (46.7%) are graduates of ceramic schools and fifty (32.5%) majored in physics and chemistry.

(*f*) Of those who published researches in the *Journal of the American Ceramic Society* in 1933, thirty-nine (41.5%) were graduates of ceramic schools and forty-two (44.7%) were graduates from general science courses.

(*g*) Of the sixteen chairmen and secretaries of Divisions in the Society, only seven studied ceramics in college, two of these seven only as post-graduates.

(*h*) Of those who are directing collegiate ceramic departments, Parmelee (Ill.), Holmes (N. Y.), Taylor (Pa.), and Norton (M.I.T.) specialized in physics and chemistry in their undergraduate work; none of them had taken work in a ceramic school nor had been employed full time in a ceramic industry prior to his acceptance of an instructorship in ceramics.

Among the other prominent ceramic instructors in colleges, Bole (Ohio), King (Ohio), Andrews (Ill.), Scholes (N. Y.), and Vieweg (N. J.) took their undergraduate work in general science. Three of them (Bole, Scholes, and Vieweg, all with doctor's degrees) had no contact with college ceramics prior to the completion of their graduate work for advanced degrees.

The Division leaders in the Ceramic Section of the U. S. Bureau of Standards are for the most part men who did not study ceramics in college. The Director of the Ceramic Section at the Bureau did not study ceramics in college.

These data show that the scientific and technical leadership in ceramics after forty years of collegiate ceramic teaching is not being held by graduates of ceramic departments. The situation revealed by these data is sufficient reason to doubt whether the curricula of our ceramic schools are giving the training needed for leadership in ceramic arts, science, and technology.

The writer of this editorial, having completed the required study course and earned the collegiate degree of Ceramic Engineer, having earned honorary Sigma Xi membership because of collegiate accomplishments in ceramics, having taught ceramics in two of the leading universities for a total of eleven years, having served the American Ceramic Society in several official capacities, the last thirteen years as Editor and General Secretary, and having worked eleven years full time in industrial ceramics, believes he is qualified to state the following opinions:

(1) Collegiate departments with specialized applied science courses of studies are fundamentally correct in theory.

(2) Ceramic science is the physics and chemistry of compounding, forming, and firing earthy materials into specified products.

(3) The economic magnitude of ceramic industries and the peculiar or distinctive technical problems of ceramic-ware production warrant special collegiate training in ceramic art, ceramic science, and ceramic engineering in universities of those states in which ceramic industries are actually or potentially of industrial importance.

(4) The greatly increased facilities of ceramic industries to produce ware economically that meets exact specifications are creditable directly and indirectly to the specialized training of men and to researches on ceramic problems in university ceramic departments.

(5) The employment of ceramic school graduates by the industries is increasing with the constantly increasing need for operating economy,

greater versatility in production of products, increasing severity of product specifications, and the increasing competition of nonceramic products.

(6) The increase in the ability and facility of ceramic industries has repaid the cost and justified the existence of collegiate ceramic schools.

(7) The present question does not concern the justification of ceramic schools and their study curricula but the manner in which the schools can better equip their graduates for industrial employment in ceramics.

(8) That the men whose undergraduate preparation was in physics, chemistry, geology, and mineralogy rather than in special ceramic courses have been successful in industrial ceramics and that they, on this the fortieth anniversary of the establishment of the first ceramic school, predominate as leaders in the promotion of ceramic arts, science, and technology make it evident that the ceramic school curricula should include more of the fundamental science courses.

(9) That engineering colleges generally are requiring less mathematics, physics, and chemistry in their special departmental curricula is deplorable and gives ample reason for a vigorous examination by the university authorities into the situation.

(10) There is no justifiable reason why the departments of mathematics, physics, and chemistry could not give the work needed by engineers. If those who are responsible for the engineering curricula believe that these fundamental subjects are not properly taught, there surely are ways of correcting the situation.

(11) Inadequacy in the teaching of the fundamentals should not be tolerated and certainly should not be taken as justification for depriving the undergraduates of this essential groundwork training for maximum industrial service and accomplishments.

(12) Courses in training in modern languages, including English and public speaking, would add greatly to the preparedness of engineering graduates for industrial service, but these are not as essential as the fundamental sciences and certainly not as essential today as they were a few decades ago.

(13) Where salaries, size of staff, and departmental operating budgets are based on the number of students registered in a given department rather than on the industrial importance of the services to be rendered by the graduates, the departmental chairmen have had to devise as many courses of studies as possible with the result that there are several specialized applied science courses that are merely reviews of published information. That such courses result in a waste of the students' time is evident by the two-fold fact that (*a*) the information and training given in such courses are possessed and apparently better understood by those whose training was exclusively in the general sciences and (*b*) the information transmitted is largely the sort that is readily acquired from general reading and observation.

(14) From the standpoint of operating efficiency as well as from the standpoint of reputation accruing from the better services rendered by their graduates, the universities should confine their specialized applied science courses to the laboratory studies of industrial problems.

(15) All chemistry, physics, geology, mineralogy, and mathematics should be given exclusively in the respective departments devoted to these subjects. It is expected and presumed that the teaching staffs of these departments are more up-to-date and keener thinkers in their special lines than the instructors in applied science courses could possibly be. If such is not the case a change in the personnel should be made by the university executives rather than to allow the applied science instructors to attempt to teach these fundamental courses.

Certainly the inadequacy of the ability of either the fundamental or applied science instructors should not be the basis for curricula changes; change the instructors rather than the curricula.

(16) The objective of collegiate curricula is to give the best possible training to graduates. School politics, customs, or generally practiced methods should not prevent the fullest attainment of this objective.

(17) When the data are reviewed without prejudice and unharassed by school traditions it will be concluded that the most versatile and successful engineers are those who are most thoroughly trained in the fundamental sciences.

(18) The conclusion of such reviews would be to devote the first three years exclusively to fundamental and general educational studies, giving applied science courses only in the fourth year.

ACTIVITIES OF THE SOCIETY

Officers of the Industrial Divisions

L. E. Barringer, E. deF. Curtis	Art	George H. Brown, C. H. Peddrick, Jr.	Materials and Equipment	J. O. Everhart, W. C. Rueckel	Structural Clay Products
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H. H. Blau, S. R. Scholes	Glass			Louis Navias, R. F. Geller	White Wares

THIRTY-SIXTH ANNUAL MEETING, HOTEL NETHERLAND PLAZA, CINCINNATI, FEB. 11-16 INC.

ART DIVISION PROGRAM

L. E. Barringer, *Chairman* E. deF. Curtis, *Secretary*

E. deF. Curtis, *Papers and Program*

H. E. Mahan to Take Mr. Ryan's Place*

Owing to the illness of W. D'Arcy Ryan, he will be unable to take part in the Art Division Program as planned, but H. E. Mahan will address the Society on the same subject as announced for Mr. Ryan, "The History of Architectural Illumination." Mr. Mahan has long been associated with Mr. Ryan in the development of feature lighting, especially for expositions, and is well qualified to handle the subject effectively.

Additional Art Division Titles

The Construction of an Antique Greek Figure in Terra Cotta

By Charles F. Binns, *formerly head of The Department of Ceramics, N. Y. State College of Ceramics,* Alfred, N. Y.

A Series of Raw Leadless Glazes at Low Temperature

By Clarence W. Merritt, *Dept. of Ceramics, N. Y. State College of Ceramics,* Alfred, N. Y.

Special Art Division Program on Monday, February 12, 1934†

The programs for the Monday sessions of the Art Division will open at 10:00 A.M. with the papers by R. A. Weaver, Joseph Sinel, and Harold Bopp. This session will close at 12:15 P.M.

The afternoon program starting at 2:00 P.M. with papers by H. E. Mahan (substituting for W. D'Arcy Ryan), Neilson C. Debevoise, Frederick Carder, and C. A. Philhower, will close at 5:00 P.M.

The remaining Art Division program contributors will be heard on the Wednesday program.

FREDRICK R. CARDER TO DISCUSS ARTISTIC GLASS

"Artistic Glass from 1900 to the Present Day," the paper to be presented by Fredrick R. Carder at the Art Division meeting of the Society on February 12, should be of interest not only to those directly concerned with the design and production of glass products but also to ceramic designers generally, for Mr. Carder speaks from a wealth of experience and achievement.

Born and educated in England and in his student days recipient of the National Gold and Silver Medals for Sculpture, Mr. Carder became, at an early age, designer for one of the outstanding glass manufacturers of England.

Fredrick R. Carder

He was Master of the Wordsley School of Art for ten years and teacher of glassmaking for the Staffordshire County Council. He was also personally responsible for important exhibitions, reports, and other activities before coming to this country in 1903 and starting the Steuben Glass Works at Corning which he managed until 1931. When the Steuben Glass Works was united with the Corning Glass Works, Mr. Carder became art director of the organization and has served since in that position.

In 1927 Mr. Carder was awarded the Friedsman Gold Medal by the Architectural League which is awarded periodically for the highest service to art and industry.

He is a Fellow of the Royal Society of Art, London, a Fellow of the American Ceramic Society, a member of the Architectural League of New York, American Chemical Society, and the Illuminating Engineering Society.

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* See *The Bulletin*, December, 1933, p. 347.

† For definite titles of papers for these authors see *The Bulletin*, October, 1933, p. 307, and December, 1933, p. 347.

R. A. WEAVER SPONSORED BY ART DIVISION TO SPEAK ON MONDAY GENERAL SESSION PROGRAM

An Ancient Art Has Become a Modern Industry

Porcelain enamel was used as early as 5 B.C. for decorative purposes, and today this industry stands as one of the few that came successfully through our depression era. The five different types of art enameling and the various stages of the changes into commercial enameling will be discussed in this paper.

ROBERT A. WEAVER

Robert A. Weaver, President of the Ferro Enamel Corporation, Cleveland, Ohio, was the founder of the Ferro Enamel Supply Company which was formerly a sales organization for the Ferro Enameling Company. These companies merged to become the Ferro Enamel Corporation.

After graduating from college he started his career in the stove business. He was the first president and a founder of the Porcelain Enamel Institute and is now the editor of a trade journal in the porcelain enameling industry, the *Enamelist*.

He is a collector of art pieces in porcelain enamel and has snuff boxes, medallions, brooches, etc., which have received publicity in various magazines.

UNIVERSITY OF CINCINNATI CERAMIC ART DEPARTMENT EXTENDS INVITATION TO CERAMISTS

The University of Cincinnati includes in the School of Applied Arts a department of ceramics. Essentially a design course, it operates on the coöperative plan of half time in school and half time in industry. There has been no effort to encourage a large enrollment and graduates have been few in number. These coöperative students have been employed in the clay, glass, and enamel industries, and all of the men who have been graduated are employed in the ceramic field.

Modern tea set, designed and executed by a ceramic art student.

The School of Applied Arts and the Ceramic Department, through Harold S. Nash, professor in charge of ceramics, will be glad to welcome visitors during the Annual Meeting of the Society in Cincinnati, the week of February 11, 1934.

HAROLD F. BOPP TO DELIVER ADDRESS AT ANNUAL MEETING, CINCINNATI, WEEK OF FEBRUARY 11

Mr. Bopp's address is entitled "Art and Science in the Development of Rookwood Pottery." He will present a history of the development at Rookwood, the organization, the art, the production, and the different types of ware and the methods used to produce them. He will also discuss the art and technical problems encountered and will explain the experiments and methods used to solve them.

HAROLD F. BOPP

Mr. Bopp, technician at Rookwood Pottery, was graduated from the University of Illinois in 1919 and since that time has worked in the clay and color industries. Soon after he came to Rookwood to assist Stanley Burt, Mr. Burt was compelled gradually to relinquish his responsibilities because of ill health. For the past four years Mr. Bopp has successfully and modestly carried on this work alone. He has been successful not only in controlling the Rookwood methods, colors, and glazes already established but he has also added new types. Chief among these are the glazes in the character of the Chun ware of the Sung period and a clear red glaze from iron at high temperatures.

CINCINNATI ART MUSEUM INVITES CERAMISTS

During the month of February, the Cincinnati Art Museum will arrange a small chronological exhibition of the ceramic arts which will be made up from the interesting groups of pottery and porcelain covering most of the important periods. Apart from this exhibition other exhibits will be seen such as a collection of objects from the Meissen factory which, although small, is comprehensive; an excellent collection of prehistoric and modern American Indian pottery; a small group of French 18th Century pieces; a classical collection; objects from the kilns of the Near East; productions of Rookwood Pottery; and modern European pieces. An exhibition of glass will also be assembled.

Porcelain goose boy of Meissen; contemporary German by Paul Bürner.

The exhibitions are being arranged in honor of the members of the American Ceramic Society who will be guests of the City of Cincinnati the week of February 11, 1934.

The ceramists are invited to visit the Museum as frequently as possible. In addition to the exhibits of pottery and glass the guests are invited to view the collections of paintings. The Museum staff is prepared to extend every courtesy to the guests.

JOSEPH SINEL TO LECTURE ON DESIGN IN MODERN INDUSTRY*

General Plastics, Inc., has this to say of Mr. Sinel:

A New Zealander by birth, Sinel came to New York via the three corners of the earth, including England, where he lived for five years, graduating through printing design to applied art. His interest in industrial designing awaited his coming to America in 1918, and his practicing of it awaited American industry's realization that there was such a thing.

Sinel is an artist, an exquisite artist. If you tell him he's as much an engineer, he'll deny it. And yet his engineering sense, his simplicity and complete practicalness have won the hearts of many clients—leading manufacturers such as Dictograph Products (Acousticon), RCA-Victor, Hoffman Beverages, Westinghouse, Texaco, International Ticket Scale, Van Camp's, Davis Welding and Manufacturing, and Schick Razor.

A lot of us are talking these days about the rational approach to any problem, whether it be compact, gravy ladle, truck, house, or gasoline station. We talk, but Sinel does it. He's so consistently sane, so completely logical, that you want to yell out against all the needless ugliness in the world, steal his portfolio, and run away to contemplate in peace the idea of an industrial Utopia.

How did he get that way? We don't know—he probably doesn't either. It just happened. It's lucky for a lot of people it did happen though—people like Dictograph. Not even Mr. Dictograph himself would take any of the credit from Jo Sinel for the great increase in the sales of Acousticon—now more than half of the world's hearing device business. There's a story, that Acousticon. One of the finest pieces of three-dimensional industrial design ever done.

A mild and tolerant fellow, a knack of creating entirely new forms and values, and ability to reconcile beauty with the machine and make it do a selling job: that's Jo Sinel.

* For photograph see *The Bulletin*, **12** [12], 348 (1933).

ADDITIONAL TITLES FOR GLASS DIVISION PROGRAM†

1. The X-Ray Determination of the Structure of Glass
   By B. E. Warren, Massachusetts Institute of Technology, Dept. of Physics, Cambridge, Mass.
2. (*a*) Correlation of Viscosity Measurements with Flame Working. Part I, Platinum Die and Its Development
   (*b*) Flow of Glass through Tubular Orifice
   (*c*) The Automatic Control of Temperature of Small Glass Streams
   By H. K. Richardson, Westinghouse Lamp Co., Bloomfield, N. J.
3. Condensable Vapors in a Tank Furnace Melting a Salt-cake Batch
   By J. Gregorius and W. A. Mahaffy, Pittsburgh Plate Glass Co., Pittsburgh, Pa.

†For previous list of papers to be presented before the Glass Division at the Annual Meeting see *The Bulletin* for December, 1933, p. 346; also Nos. 2 and 3 of titles on page 347.

ROOKWOOD LIVING PROOF OF PROFIT IN NONPROFITEERING INDUSTRY*

The history of Rookwood Pottery has been one of hard work and high achievement under an exacting artistic code that has left no room for commercialization. The industry as it is today has come from a mold of human lives. It is an industry in which the human element plays a major part, and the mechanical element is negligible.

A woman founded Rookwood and gave it its tradition of distinction. When she retired she left the controlling interest to a man who appreciated her ideals and who fostered the tradition until it became as essential a part of the product as the clay, the kiln, or the potter's wheel. These two lives were Rookwood's greatest initial asset.

Mrs. Maria Longworth Storer founded the pottery in 1880 and directed the work for the first ten years. Her interest in the art came after amateur dabbling in it in the company of other Cincinnati women. They would throw and decorate their own pieces, taking them to local plants to be fired. After the first fine flare of enthusiasm, the interest of most of them died, and the activity was remembered only as a temporary relief from the artistic Puritanism of the Victorian era.

But Mrs. Storer's interest did not die. The exhibit of Oriental pottery in the Philadelphia Exposition of 1876 served to arouse her to the fact that the work was for more than leisure hours, that it could become more than what her father called it—"an employment for the idle rich."

First Kiln Is Crude

Mrs. Storer's first plant was an Eastern Avenue schoolhouse which her father had bought at a sheriff's sale and turned over to her. Her first kiln stood, surrounded by a high board fence, in the back yard of the house. The decoration work was her own, and her helpers were the two sons of Joseph Bailey, a potter from Staffordshire, England, who later became chemical director of a growing Rookwood.

The name "Rookwood" Mrs. Storer adopted partly because it was the name of her father's estate. But the real roots of the name were even farther back than that. Crows in an old, dead elm tree really began Rookwood Pottery.

In 1883 William Watts Taylor became manager of Rookwood, in the hope of making it a permanent, paying proposition, rather than merely a temporary drain of Mrs. Storer's personal fortune.

The seeds of financial soundness sown by Mr. Taylor first made themselves felt in 1889. The Paris Exposition of that year awarded a gold medal to Rookwood exhibits. Several previous prizes and mentions had been won, but the Paris award made Rookwood more than a name only. Rather, Rookwood became a significant name, a name that stood for only the highest quality.

Taylor in Control

With Mrs. Storer's retirement in 1891, Mr. Taylor received a controlling interest in the plant, which he held until the time of his death in 1913, when the pottery be-

* Excerpts from *The Cincinnati Post*, October 7, 1933. See also Rookwood Pottery photograph in the December issue of *The Bulletin*, p. 348.

came the ward of five trustees, a community possession with the one goal of new achievement. William Watts Taylor's was the second life that molded Rookwood.

In 1891 the pottery moved from the Ohio River to the crown of Mt. Adams, where it stands today, visible from almost every part of downtown Cincinnati. The original building has been added to several times, but the old English style has never been altered and the plant looks more like a country home than a factory.

Time has been sifted before it has been allowed to touch Rookwood. The progress of the 20th Century has been permitted entrance, but never the 20th Century industrialization. There is serenity within the factory walls that belongs to another day than this. Yet the record of Rookwood successes is not surpassed by that of any modern manufacturer.

The potters' trade is one of the oldest trades in the world. Two thousand years before the Christian era dead pieces of clay were given life on the potter's wheel. The technique of drawing clay by that method has seen little change since.

Ancient Industry

The ancient Egyptians baked their formed pieces in a kiln that differed only accidentally from the kiln of today. Only the casting process, in which the liquid clay is poured into a mold and dried to form is new, and that is a century old at least.

Those who work at Rookwood are conscious of the romance of their heritage. Somehow they give their ideals and beliefs to their children and their children carry on the work. Today at Rookwood there are many whose fathers preceded them at the plant.

Long service is the ordinary thing at Rookwood. The present president, J. H. Gest, former director of the Cincinnati Art Museum and Academy, was vice-president during a good part of Mr. Taylor's term. At 76, his tall, spare frame is still active enough for early morning excursions into the country to paint pictures that have all the color and spirit of youth.

Like most Rookwood executives and like his distinguished Van-Dyked contemporary, Mr. Gest, John Wareham, present vice-president, graduated from the ranks of the artists. Bespectacled, fit-looking, and suave, he designs occasional pieces, cares for the firm's more troublous illnesses, and carries Rookwood pottery on the radiator cap of his car.

Work Unrestricted

Since the discovery of Tiger-Eye, Rookwood's famous sheen-of-gold process, and Vellum, the smooth, cool, rich finish, through individual experiments of the artists, Rookwood has placed no restrictions on its decorators' work. They do not have to fulfill any schedule or produce any particular model. Their own inspiration is their time clock.

The freedom of the artists in their work has been a great contributing factor to Rookwood's growth. Even today a decorated piece, signed on the bottom with an artist's signature, is unique. When two similar pieces are made to complete a pair, the design is slightly varied and each remains the only of its kind. Only pieces cast in the mold for large distribution occasionally carry the signature on many reproductions. But they are plain, not decorated.

The factory on Mt. Adams, at the top of the Eden Park incline, is open to visitors daily. Several rooms on its ground floor are used for exhibition of the pieces. Trips are made to the workshops below every half hour.

There is no bustle, there is no noise, there is no confusion in the shops. The men work where sunlight falls, and beyond the white-dust atmosphere of the casting and setting rooms, they can see the bright green of the foliage Rookwood executives have planted on what was once a barren hillside. From their basement windows, they can look down on a smoke-blanketed city below and beyond into the distance, and can see through the man-made mist other factories, less fortunate workers.

Rookwood is local and world wide. It is proud of its home and yet is celebrated everywhere.

A visitor from the east to whom the plant was pointed out once said, "Rookwood. I didn't know they had a branch here."

An average number of 125 workers in all, never more, has elevated Mrs. Storer's "crows on an old, dead elm tree" to a place of international fame. Rookwood today is a living proof of the profit of a nonprofiteering industry, where the president and the potter feel an equal pride in the production.

ENAMEL DIVISION PROGRAM

A. I. ANDREWS, *Chairman* — R. M. KING, *Papers and Program* — W. N. HARRISON, *Secretary*

9:30 A.M., Tuesday, February 13, 1934

1. Zirconium Opacity in Enamels, Glazes, and Glasses.

   By C. J. Kinzie and C. H. Commons, *The Titanium Alloy Mfg. Co.*, Niagara Falls, N. Y.

   The subject of zirconium opacity is discussed from the theoretical and practical standpoint.

2. The Graphical Computation of Opacity of Porcelain Enamels.

   By G. H. McIntyre, *Ferro Research Laboratories*, Cleveland, Ohio.

   The use and calculation of reflectivity data in connection with opacity is discussed.

3. Titanium Compounds and Application Thereof in Vitreous Enamels.

   By C. J. Kinzie and J. A. Plunkett, *The Titanium Alloy Mfg. Co.*, Niagara Falls, N. Y.

   The various titanium compounds available and the general subject of their properties and effects in vitreous enamels are presented. Acid-resisting enamels are given particular attention.

4. Die für das Haften wesentlichen Vorgänge beim Einbrennen von haftoxydfreien Grundemails. (Firing Procedure Necessary to Obtain Adherence with Ground Coats Containing no Adherence-Promoting Oxides.)

   By A. Dietzel and K. Meures, *Institut für Chemische Technik, Technischen Hochschule*, Karlsruhe, Germany. (Translated by R. M. King.)

5. Über die Frage der Anpassung von Emails an Eisenblech. (The Fitting of Enamels on Sheet Steel.)

   By A. Dietzel and K. Meures, *Institut für Chemische Technik, Technischen Hochschule*, Karlsruhe, Germany. (Translated by R. M. King.)

2:00 P.M., Tuesday, February 13, 1934

6. The Mechanics of Enamel Adherence. IX, Equilibrium Studies in Some Systems Containing Ground-Coat Glass, and Cobalt, Nickel, and Iron Oxides.

   By Geo. H. Spencer-Strong and R. M. King, *Dept. of Ceramic Engineering, Ohio State University*, Columbus, Ohio.

   The crystal phases separating at the enamel iron

interface under conditions approaching equilibrium between the various components of the system have been determined and are discussed.

7. The Mechanics of Enamel Adherence. X, The "Iron Oxide" Layer in Fired Ground Coats Containing Cobalt Oxide.

   By R. M. King, *Dept. of Ceramic Engineering, Ohio State University*, Columbus, Ohio.

   The formation and significance of the so-called "iron oxide" layer has been studied experimentally and is discussed in this paper.

8. The Mechanics of Enamel Adherence: Progress Report on Application of Theory of Dendritic Adherence in the Development of White Ground Coats.

   By W. L. Housley and R. M. King, *Dept. of Ceramic Engineering, Ohio State University*, Columbus, Ohio.

   Metal dendrites have been obtained by use of some colorless oxides. Their determination and possible significance are discussed.

9. Use of Finely Milled Enamel Slips.

   By F. R. Porter and H. H. Holscher, *Edison General Electric Appliance Company*, Chicago, Illinois.

   In general, cover-coat slips for sheet iron are milled to give a residue of from 3 to 5% on a 200-mesh sieve. It has been the consensus of opinion that finer milling would result in tearing. However, cover-coat slips milled to 1 to 2% on a 325-mesh sieve are now in use in production with no tearing and with the following advantages (1) higher opacity, (2) less wear on spray guns, (3) smoother finishes, (4) lower firing temperatures, and (5) better suspension.

9:00 A.M., Wednesday, February 14, 1934

10. Further Data on Reboiling of Sheet-Iron Ground-Coat Enamels.

    By A. I. Andrews and R. E. Mullady, *Dept. of Ceramic Engineering, University of Illinois*, Urbana, Illinois.

    The reported characteristics of the reboiling phenomenon have been checked and additional data obtained which influence reboiling.

11. Enamels and Some Enamel Defects in the Light of Glass Technology.

    By D. J. McSwiney, *Dept. of Ceramic Engineering, Ohio State University*, Columbus, Ohio.

12. A Further Progress Report on the Study of Gases in Enameling Iron.

    By H. N. Lucian, *Dept. of Physics, University of Pennsylvania*, Philadelphia, Pa., and Karl Kautz, *Republic Steel Corporation*, Massillon, Ohio.

13. Discussion of Reboiling. Led by A. I. Andrews, *Dept. of Ceramics, University of Illinois*, Urbana, Illinois, and J. O. Lord, *Dept. of Metallurgy, Ohio State University*, Columbus, Ohio.

2:00 P.M., Wednesday, February 14, 1934

14. Effect of Water Hardness on Vitreous Enamel Suspensions.

    By A. I. Andrews and E. G. Porst, *Dept. of Ceramic Engineering, University of Illinois*, Urbana, Illinois.

    A study of the effect of natural waters of varying hardness on the yield values and mobilities of enamel slips using the Gardiner mobilometer is given.

15. Mechanics of Enamel Suspension. I, A Study of Vallendar Clay.

    By G. E. Terry and R. M. King, *Dept. of Ceramic Engineering, Ohio State University*, Columbus, Ohio.

    Studies of the properties of Vallendar clay were made to determine their special adaptability for enamel slips.

16. The Effect of Fluorides on the Thermal Expansion of Sheet-Iron Cover Enamels.

    By A. I. Andrews and E. E. Howe, *Dept. of Ceramic Engineering, University of Illinois*, Urbana, Illinois.

    An investigation was made of the effects of the common fluoride additions to typical sheet-iron cover enamels on thermal expansion. The interferometer was used to measure the expansion.

17. Thermal Expansion of Enamels Expressed in Terms Which Do Not Change with Temperature.

    By W. N. Harrison, B. J. Sweo, and G. M. Shelton, *U. S. Bureau of Standards*, Washington, D. C.

    Data are given to show how to express expansion characteristics of enamels in terms of two constants which are applicable throughout the range from room temperature to the critical temperature.

18. Temperature Control of the Ground Coat as a Part of Process Control.

    By H. C. Beasley and E. C. Davidson, *Servel, Inc.*, Evansville, Ind.

    Control of temperature of the ground coat from the time it leaves the mills until it is dipped on the ware and the effect it has upon the enamel and on the production of satisfactory liners for refrigerator boxes are discussed.

19. Enameling of Copper.

    By Harold E. Simpson, John B. Sullivan, *Battelle Memorial Institute*, and George A. Bole, *O. S. U. Engineering Experiment Station*, Columbus, Ohio.

20. Committee Reports.

REFRACTORIES DIVISION PROGRAM

R. A. HEINDL, *Chairman* ROBERT B. SOSMAN, *Secretary*

R. E. BIRCH, *Papers and Program*

9:30 A.M., Tuesday, February 13, 1934

1. Approximate Composition of the Lowest Fusing Mixture of Barium Oxide, Magnesium Oxide, and Silica. Presented as a thesis for the degree of Bachelor of Ceramic Engineering at Ohio State University, Columbus, Ohio. By Cecil H. Turner.

   Varying mixtures of BaO, MgO, and SiO_2 were made into cones and fired to determine the temperature at which they would fuse. The direction of falling temperature as determined by their relative fusion temperatures converged to an area whose center represented a mixture the composition of which was approximately 46.0% by weight of BaO, 8.0% by weight of MgO, and 46.0% by weight of

SiO_2. The first signs of fusion occurred in this mixture at standard pyrometric cone 1 (3 o'clock).

2. Distribution of the Chief Refractory Clay Deposits of the United States.

By J. R. Chelikowsky, *Department of Geology, Cornell University*, Ithaca, N. Y.

A chart has been prepared showing the geological distribution of refractory clays in the United States. Assistance in obtaining data has been given by the manufacturers of refractories through the American Refractories Institute and the Research Committee of the Refractories Division, and by the various state geologists and Heinrich Ries.

3. The Thermal Conductivity of Refractories at High Temperatures.

By Gordon B. Wilkes, *Dept. of Ceramics, Massachusetts Institute of Technology*, Cambridge, Mass.

The thermal conductivity apparatus used in the work on magnesite brick as reported in the *Journal of the American Ceramic Society*, Vol. 16, March, 1933, p. 125, has been utilized in determining the thermal conductivity of silicon carbide (recrystallized and clay-bonded), silica, and fireclay brick from room temperature to 2500°F.

4. Drying Clay Ware by Use of Alternating Current.

By J. Otis Everhart, *O. S. U. Engineering Experiment Station*, Roseville, Ohio.

Plastic ceramic bodies when subjected to the passage of an electric current are heated appreciably. When direct current is used this heating is nearly uniform throughout the entire body. It is possible to heat the ware to any temperature under the boiling temperature of water. Drying is much faster and it is hoped that the ware may also be dried more safely. Data are presented showing the results obtained in drying a number of laboratory and commercial size test specimens.

5. Relation between Uncombined Quartz and Thermal Expansion of Ceramic Bodies.

By W. R. Morgan and C. W. Parmelee, *University of Illinois*, Urbana, Ill.

6. Petrography and Heat Treatment of Chromite Refractories.

By Gilbert E. Seil, *E. J. Lavino and Company*, Philadelphia, Pa.

The factors entering into the solution of a research problem on refractory materials are discussed. Special attention is given to the use of the petrographic and other microscopes in refractory research and it is pointed out that petrography is not a universal tool with which to conduct and evaluate research.

The petrographic study of commercial chrome ores has shown that each of these ores is composed of two components, (1) the primary component which is a chemical entity, the bases being MgO and FeO and the acids, Al_2O_3 and Cr_2O_3, in which the molecular sum of the acids always equals the molecular sum of the bases, and (2) the secondary component which consists of various magnesium silicate minerals sometimes contaminated with small amounts of iron, alumina, etc.

The effects of the percentages and of the placement of the two components in various chrome ores are discussed.

Ores which have been corrected physically or have been corrected physically and chemically are studied petrographically. The characteristics of brick made from crude ore, physically corrected ore, and physically and chemically corrected ore are enumerated. Photomicrographs of various types of crude chrome ores and physically corrected and physically and chemically corrected chrome ores are included. There are also photomicrographs showing the effect of heat treatment on quartzite.

Photographs showing comparative spalling tests, load tests, and sagging tests on brick made from the crude and corrected ores are included, together with expansion curves on these brick.

2:00 P.M., Tuesday, February 13, 1934

7. Crystals, Solids, Glasses, and Liquids.

By Robert B. Sosman, *U. S. Steel Corporation Research Laboratory*, Kearny, N. J.

In the study of the various states of aggregation of matter much confusion has been caused by the overlapping of nonexclusive criteria. This introductory paper of the Symposium will attempt to clarify these concepts in their relation to the states of aggregation of ceramic materials. The most fundamental distinction is that between chaotic and crystalline phases; the next, that between expansive and condensed phases. Further classification of the condensed phases may follow several lines, the commonest being their division into fluid and resilient phases.

8. Methods of Inducing Crystallization.

By Edward W. Washburn, *Chief, Chemistry Division, U. S. Bureau of Standards*, Washington, D. C.

Among the factors which are important in inducing the molecules of a difficultly crystallizable substance to arrange themselves into a crystal lattice are the following: (1) contact with or solution in a medium of low viscosity; (2) enhancement of orientating forces by use of sufficiently low temperature; (3) low concentration, if large crystals are wanted without seeding; (4) seeding, if possible and desirable; and (5) absence of substances which by adsorption inhibit crystal growth.

Examples illustrating the application of the above principles in practice are given.

9. Reactions between Solids in the Absence of a Liquid Phase.

By Nelson W. Taylor, *Dept. of Ceramics, Pennsylvania State College*, State College, Pa.

Finely divided solids in intimate contact frequently react chemically with one another. Although the reaction may be greatly accelerated by the presence of a liquid phase, the liquid is not necessary for the reaction. In the presence of a liquid the direction of reaction is usually determined by the formation of an insoluble product, or by the production of a

gas, but in absence of a liquid the direction and driving force of the reactions are measured by the free energy change which may be expressed in terms of the lattice or crystal energy of the constituents.

The reactivity of an ionic type of solid is enhanced by those factors which weaken the inter-ionic forces. Such factors are heat, structure rearrangement at transition temperatures, ionic distortion due to polarization, solid solution, etc. Specific heat curves of solids show temperatures at which they are acquiring considerable vibrational or rotational energy and therefore indicate temperatures at which reactions are possible. High temperature specific heat data are greatly needed in connection with the study of reactions of solids.

The lattice type of a crystal of an inorganic substance may be true ionic or it may be essentially an oxide lattice, *e.g.*, $A^{++}BO_4^{=}$ or $AO \cdot BO_3$ and the mechanism of reaction will be different. In a reaction like $A'O + ABO_4 = A'BO_4 + AO$, if BO_3 is a volatile oxide, the reaction may consist essentially in a distillation of BO_3 from AO to A'O.

The velocity of a solid phase reaction is primarily determined by the heat of activation, or "work of loosening" of the constituents. This quantity can be obtained from the kinetic data itself and varies in magnitude from a few hundred calories per mol to almost the heat of fusion. The greater the value of the heat of activation, the slower is the reaction. The other important factor in controlling the speed is the particle size.

Solid phase reactions permit the preparation of many materials which can not be made in the wet way. Silica reacts with alkali earth oxides at temperatures as low as 400°C. Lime reacts with sillimanite as low as 530°C to give calcium metasilicate and alumina. In the field of ceramics many structural changes frequently occur far below the eutectic temperature of the system. One example of this is indicated by the marked heat evolution which occurs in kaolin at about 900°C. An important reaction of the Portland cement industry is the dissociation of tricalcium silicate, $3CaO \cdot SiO_2 \longrightarrow 2CaO \cdot SiO_2 + CaO$, which runs with maximum speed at about 1150°C.

In the field of geology the processes of so-called thermal metamorphism are essentially solid phase reactions, and give rise to the formation of such minerals as staurolite, andalusite, and garnet. Research is now in progress at the Pennsylvania State College with the object of systematic synthesis of silicates by reaction between solids.

10. Crystal Changes in Refractory Bodies in Firing and in Service.

By Herbert Insley, *Petrographer, U. S. Bureau of Standards*, Washington, D. C.

The types of crystalline changes discussed in this paper include (1) growth and solution of crystals, (2) polymorphous inversions, (3) dehydration and consequent crystalline changes, and (4) decomposition of crystalline compounds. These changes are illustrated by reference to the heating and the reaction with slags and furnace atmosphere of such refractory materials as magnesite, silica, alumina, kaolin, and mullite.

11. Identification of Crystalline Substances by Means of the Petrographic Microscope.

By T. N. McVay, *School of Chemistry, Metallurgy, and Ceramics, University of Alabama*, University, Alabama.

The writer compares X-ray, thermal expansion, specific gravity, and petrographic methods for determining crystallinity, chemical and physical changes, and the value of each. A short review is given of the results obtained by petrographic methods as applied to refractories. Thin section and immersed grain petrography are compared. Suggestions are made regarding the development of much-needed high index immersion mediums. Possibilities of a more extended use of the fluorescent argon bulbs are indicated.

12. Identification of Crystalline Substances by Means of X-rays.

By B. E. Warren, *Dept. of Physics, Massachusetts Institute of Technology*, Cambridge, Mass.

Methods of preparing X-ray diffraction patterns of crystalline materials, the significance of an X-ray diffraction pattern, and its relation to the sample material are presented. Methods are also given for identification by (*a*) direct analysis of pattern, and (*b*) comparison with diffraction patterns of known materials. Difficulties in classifying and cataloguing diffraction patterns are listed. The identification of a completely unknown material is therefore, in general, not possible. Except in special cases it is necessary to have some additional information such as an approximate chemical composition. Difficulties in identification are encountered when more than one crystalline compound is present. Advantages of X-ray diffraction identification are as follows: (*a*) a definite crystalline modification is identified (not simply a chemical compound or chemical composition); (*b*) sharp differentiation between crystalline and amorphous or glassy modifications; (*c*) identification of different components when individual grains are submicroscopic in size; (*d*) the diffraction pattern consisting of a large number of lines which must fit the known pattern both with respect to the positions of the lines and their relative intensities; considerable data are available, and hence the identification by an X-ray diffraction pattern is in general very definite; and (*e*) the production of an X-ray diffraction pattern is very simple.

9:30 A.M., Wednesday, February 14, 1934

13. A Study of the Working Properties of Silica Mortars.

By Sandford S. Cole, *Graduate Student, Pennsylvania State College*, State College, Pa.

The settling test data were found to be in accord with the rate of water removal and with the water content for proper working consistency. A modification of the Burmister method for concrete was found to be most satisfactory for evaluating the workability of silica mortars. Settling test and water

removal test are described. The effect of p_H and colloidal agents on working properties is shown to be quite pronounced.

14. A Study of the Effect of Natural Gas and of Hydrogen upon Various Refractories.

By B. C. Ruprecht, R. H. H. Pierce, and Fred A. Harvey, *Research Department, Harbison-Walker Refractories Co.*, Pittsburgh, Pa.

Natural gas was passed through an electric tube furnace where it was partly cracked and then through a second furnace containing a sample of a refractory. The refractories tested were fireclay brick of various types and fired in various manners and brick made of magnesite, high alumina material, and silica. The action on the refractory was similar to that of carbon monoxide. Carbon was deposited in some of the refractory bodies within a critical temperature range. Some of the fireclay bodies were almost completely disintegrated by the growth of the carbon deposits, although others were scarcely affected. Hydrogen gas had no disintegrating action at any temperature studied.

15. Informal Report on the Boiler Refractories Investigation (The A.S.M.E. Committee on Boiler-Furnace Refractories)

By T. A. Klinefelter, *U. S. Bureau of Standards*, Washington, D. C.

Several important developments have appeared in the laboratory work in connection with this problem. It has been found necessary to study the various phases present in the slags at the boiler operating temperatures by means of quenched samples rather than by slow cooling. By this procedure it has been found that any given coal-refractory combination has a safe working range, a critical temperature interval before rapid corrosion of the refractory takes place, and finally the higher temperature range where the slag becomes extremely corrosive in action. A test was developed to locate these various ranges. A general study has also been made of the system involving lime, alumina, silica, and iron, as these were found to be the chief components of most of the slags.

16. The Measurement of Reaction Rates at High Temperatures.

By J. H. Chesters (*British Commonwealth Fellow*) and C. W. Parmelee, *Dept. of Ceramic Engineering, University of Illinois*, Urbana, Illinois.

Cylindrical test pieces made from the materials to be investigated were heated to, and maintained at, a given temperature in an expansion apparatus.

The rate of inversion of quartz to cristobalite and the rate of reaction between spinel-forming oxides were determined from the slopes of the expansion curves at constant temperature. The actual amount of inversion or spinel formation was determined by measurements of the specific gravity of the material before and after heating. The products of the reaction were identified by microscopic and X-ray investigations.

The rate of inversion of quartz and the rate of formation of spinel were both found to be influenced greatly by small temperature variations or additions of mineralizers.

17. The Physical Properties of Insulating Refractories.

By W. C. Rueckel, *O. S. U. Engineering Experiment Station*, Columbus, Ohio.

An investigation of eleven types of insulating brick was made. Physical properties determined included bulk density, porosity, transverse and crushing strength, pyrometric cone equivalent, volume shrinkage at 2300°F, 2500°F, and 2700°F, sag under load at 2500°F, and resistance to spalling. A study of the relation between permeability and pressure differential through the various insulating brick is included in the report.

Suggestions for classifying the various types of insulating brick into groups and a critical discussion of formulas for permeability are also given.

2:00 P.M., Wednesday, February 14, 1934

18. Some Special Studies of Refractory Georgia Kaolins.

By W. Harry Vaughan, *Dept. of Ceramic Engineering, Georgia School of Technology*, Atlanta, Georgia.

19. Release of Hand-Molded Refractory Shapes by Electric Current.

By J. Otis Everhart, *O. S. U. Engineering Experiment Station*, Roseville, Ohio.

It is possible to release hand-molded shapes from metal molds by use of direct current without the use of oil, sand, or grog on the interior of the mold. A discussion of the principles involved is presented with observations made while conducting practical tests in an Ohio refractories plant.

20. Olivine as a Refractory.

By R. A. Heindl, *Chief, Refractory Section, U. S. Bureau of Standards*, Washington, D. C.

Olivine representing three different deposits in North Carolina and one each in California, British Columbia, and Russia was tested to determine the possibilities of the material as a refractory. The chemical analyses were made on the raw materials and linear thermal expansions, specific gravities, pyrometric cone equivalents, and petrographic analyses on both the raw and heated materials. The results show that olivine from North Carolina apparently has the necessary properties demanded of a high-grade special refractory and that it must be used in industrial processes where possible contamination by iron is of no consideration.

21. The Effect of Reheating Refractories upon Their Pyrometric Cone Equivalent.

By Donald A. Dickens (1), Sandford S. Cole (2), and M. E. Holmes (3).

(1) Candidate for degree of Bachelor of Science
(2) Graduate Student
(3) Dean, New York State College of Ceramics

The pyrometric cone equivalent was obtained on twenty samples each of fire clay and fire brick, "as received," and after reheating to 1350°C, 1450°C, and 1500°C for 5 hours; to 1400°C, 1450°C, 1500°C, and 1550°C for 25 hours; and to 1450°C and 1500°C for 50 hours. The reheating was found to alter the P.C.E. in all cases. As much as two cones lower

P.C.E. from that for the "as received" samples were found, and a total variation of three cones was found in a few instances. The greatest amount of variation was found in the samples heated from 1450 to 1550°C for 25 hours. The results indicate that the P.C.E. of refractories after heating to high temperatures are not necessarily reliable and indicative of the refractory "as received."

22. Notes on the Testing of Refractories.

By C. N. Witherow, *E. J. Lavino & Co.*, Philadelphia, Pa.

The history and purpose of refractory tests are briefly reviewed. The nonhomogeneous and constantly changing chemical, physical, and mineral character and composition of refractory materials are considered in relation to the testing of the same products, and the various properties which are important from a manufacturing and service point of view are discussed. The requirements of a satisfactory test are enumerated and the various tests are discussed. The correlation of data from different tests and the importance of complete data on materials and methods used are stressed as well as the need for more fundamental research work on the mineral constituents of refractory materials.

STRUCTURAL CLAY PRODUCTS DIVISION PROGRAM

J. O. EVERHART, *Chairman* W. C. RUECKEL, *Secretary*

H. R. STRAIGHT, *Papers and Program*

Session on Firing of Ceramic Kilns

1. Control of the Combustion of the Water-Smoking Period of Kiln Firing.

By J. L. Carruthers, *Dept. of Ceramics, Ohio State University*, Columbus, Ohio.

A discussion is presented of the various factors entering into the water-smoking process. Methods of controlling combustion conditions, air-volume, humidity, and temperature are described.

2. Firing the Conventional Type Kiln Furnace.

By C. A. Austin, *Ohio Fuel and Gas Co.*, Cambridge, Ohio.

3. The Establishment of the Corrective Routine in Firing Ceramic Kilns.

By Roland J. Clark, *826 Catalpa Drive*, Dayton, Ohio.

A study is given of the successful application of the principles of combustion to plant practice, including the use of natural gas and coal. The elimination of reducing kiln atmosphere and successful smoke abatement with coal firing are emphasized.

4. The Control of Combustion During High Fire in a Ceramic Kiln.

By George A. Bole, *Engineering Experiment Station, Ohio State University*, Columbus, Ohio.

Session on General Topics

5. The Glass Phase in Heating Heavy Clays.

By George R. Shelton, *Bureau of Standards*, Washington, D. C.

The development of glass phases in a shale, a glacial clay, and an alluvial clay when tested from 400 to 1200° is presented. The petrographic microscope was used in this study.

6. Structural Clay for Metal Houses.

By Bennett Chapple, *The American Rolling Mill Co.*, Middletown, Ohio.

7. Testing Dies for Balance in a Controlled Unit Drier.

By D. A. Moulton, *Dept. of Ceramics, Iowa State College*, Ames, Iowa.

8. Kiln Floor Design.

By J. L. Carruthers, *Dept. of Ceramics, Ohio State University*, Columbus, Ohio.

9. Coal Requirements of Various Ceramic Ware in Firing.

By Ellis Lovejoy, *480 West Sixth Avenue*, Columbus, Ohio.

Electrical Session

10. Electrical Lubrication of Stiff-Mud Dies.

By J. O. Everhart, *Engineering Experiment Station, Ohio State University*, Roseville, Ohio.

Dies may be lubricated by use of direct current passed from a suitable positive electrode to the liner and cores which are so constructed as to serve as the negative electrode. The action is due to cataphoresis and endosmosis. Data are presented showing the effect of various electrolytes on current flow, the effect of various voltages, distance between electrodes, heating of electrodes, body, etc. Some discussion of commercial applications is given.

11. Arc Welding and Repairing in Ceramic Plants.

By K. L. Hansen, *Harnischfeger Corp.*, Milwaukee, Wis.

A discussion is presented illustrating the savings and uses in a ceramic plant of arc welding and repairing and hard surfacing with the arc.

12. Electric Motors for the Ceramic Industry.

By H. W. Bibber, *Electrical Engineering Dept., Ohio State University*, Columbus, Ohio.

13. Paper on "Electric Switches for the Ceramic Industry." To be presented by a representative of the Westinghouse Electric Supply Company, Inc., Chicago, Ill.

Kiln Construction Session

14. Refractory Materials for Tunnel Kilns.

By J. T. Robson, *Allied Engineering Co.*, Columbus, Ohio.

15. Further Studies of the Tunnel Kiln.

By W. D. Richardson, *Schultz Bldg.*, Columbus, Ohio.

16. Insulation of Kilns.
By W. H. Fogarty, *Power Products and Industrial Dept., Johns-Manville Company*, Chicago, Ill.

17. The History of Tunnel Kilns.
By Frank M. Hartford, *Allied Engineering Co.*, Columbus, Ohio.

18. Continuous Clay Slip Dewatering Machine.
By H. R. Straight, *Adel Clay Products Co.*, Redfield, Iowa.

WHITE WARES DIVISION PROGRAM

LOUIS NAVIAS, *Chairman* R. F. GELLER, *Secretary*

ROBERT TWELLS, *Papers and Program*

The Microstructure of Some Raw Lead Mat Glazes.
By C. W. Parmelee and William Horak, *Dept. of Ceramics, University of Illinois*, Urbana, Ill.
This is a report on the microstructure of mats found in the composition range

$$\left.\begin{matrix}0.4\text{–}0.6\ PbO\\0.2\text{–}0.3\ CaO\\0.0\text{–}0.3\ BaO\\0.0\text{–}0.3\ ZnO\end{matrix}\right\}\ 0.1\text{–}0.35\ Al_2O_3\quad 0.7\text{–}1.8\ SiO_2$$

These were fired at cones 03, 2, 4, and 6. The compounds recognized present as crystals were anorthite, celsian (probably), tridymite, and wollastonite. Willemite was not observed. The good mats were due to crystal separations. A high alumina content was not essential. Anorthite was the principal crystalline form present in mat glazes containing lime.

A Study of Some Frit Compositions.
By C. W. Parmelee and K. C. Lyon, *Dept. of Ceramics, University of Illinois*, Urbana, Illinois.
The results of a study of seventy-five frits containing Na_2O, CaO, B_2O_3, Al_2O_3, and SiO_2 indicate a relation between composition and water solution. Properties of melting, flowing, corrosion, solubility, and p_H are reported.

Terminology of Ceramic Whiteware.
By Arthur S. Watts, *Dept. of Ceramics, Ohio State University*, Columbus, Ohio.
A classification is given based on (*a*) water absorption of the body, and (*b*) character of the glaze, with definitions of each type. Commercial whiteware thus classified includes tableware, sanitary ware, electrical insulators, industrial ware, chemical ware, cooking ware, wall and floor tile, and some artware. Simple tests are presented for establishing the classification.

Table of Factors for the Calculation of Nonmetallic Minerals.
By Kenneth G. Skinner and Hewitt Wilson, *Dept. of Ceramics, University of Washington*, Seattle, Wash.
This table presents a simple method of calculation from nonmetallic compounds to oxides and the reverse for easy slide-rule manipulation. The table is found to be convenient for working out theoretical calculations.

The Kaolin Minerals; (1) Synthesis, (2) Thermal Behavior.
By Herbert Insley and R. H. Ewell, *Bureau of Standards*, Washington, D. C.

Equilibrium Relations between Alumina and Alumina Hydrates.
By R. H. Ewell, *Bureau of Standards*, Washington, D. C.

Effect of Mechanical Pressure on the Drying and Firing Properties of Some Typical Ceramic Bodies.
By A. E. R. Westman, *Ontario Research Foundation*, Toronto, Canada.
A report is given of experiments performed in a continuation of the investigations described at previous meetings. Pressing time and drying and firing properties of thicker and wider disks made from commercial bodies are reported.

American *vs.* European Tableware.
By Arthur S. Watts, *Dept. of Ceramics, Ohio State University*, Columbus, Ohio.
Popular opinions on this subject are given, and a plan is presented for a carefully organized research of American tableware in regard to bodies, glazes, and decorations leading to a publication of facts supporting the superiority of American products.

The Influence of Drying Treatment and Biscuit Storage Atmosphere on the Physical Properties of Semiporcelain.
By Horace L. Latimer and Arthur S. Watts, *Dept. of Ceramics, Ohio State University*, Columbus, Ohio.
A commercial semiporcelain body was extruded into standard test bars, dried under various conditions, fired with commercial ware, and then stored in various atmospheres. Data on change in porosity absorption and modulus of rupture were obtained at intervals up to six months.

A Study of the Effect of Grain Size of Some Feldspars on the Properties of a Standard Whiteware Body.
By Edmund A. Durbin and Arthur S. Watts, *Dept. of Ceramics, Ohio State University*, Columbus, Ohio.
Three feldspars of almost identical compositions but from three widely separate districts were ground and classified by air. Portions of three distinct grain-size groupings were chosen and introduced into a

standard body. The trials were fired in commercial kilns at two temperatures and the physical properties of the various products were compared.

A Note on Old Russian Chinaware.

By George J. Middleton, *Dept. of Ceramics, University of Washington*, Seattle, Wash.

The author has been fortunate in securing a representative set of china pieces from the Hammer-Russian collection dating from 1823 to the last czar. A petrographic study has been made of the bodies and glazes and compared with those of modern china and porcelain. A short historical sketch and photomicrographs are given.

One Man Automatic Decorating Kiln.

By John T. Jans, *6545 Epworth Blvd.*, Detroit, Mich.

On most modern continuous decorating kilns one man can place and draw from 350 to 450 dozens of dinnerware in about eight hours. This paper deals with a completely automatic unit designed to have a capacity of 1200 dozen or three such shifts per day. The purpose was to fire this ware at a per dozen cost comparable to that in the larger capacity kilns. The kiln is the rotary hearth type, 24 feet in diameter on the center line, and is driven continuously by a series of radial hearth support rolls moving at a uniform speed. It is muffled, natural-gas fired, and has automatic temperature control. The entire hearth and all of the rolls above 1000°F are chrome nickel alloy castings.

Some Phases of Plastics.

By F. P. Hall, *Onondaga Pottery Co.*, Syracuse, N. Y.

Fundamentals Involved in the Use of Auxiliary Fluxes in Whiteware Bodies.

By Arthur S. Watts, *Dept. of Ceramics, Ohio State University*, Columbus, Ohio.

Unless other considerations than mere cheapness of production are involved, the auxiliary flux will probably never find commercial use in the whiteware industry. Its most promising field of utilization lies probably in producing a dense ware without the faults arising from high feldspar content. Published data have been limited to very fusible frits which in many cases are slightly soluble and are so fluid at the maturing temperature of the body that vesicular structure and distortion of the ware are likely to result.

Notes on Casting Slip.

By Edward Schramm and F. P. Hall, *Onondaga Pottery Co.*, Syracuse, N. Y.

Observations and experiences in casting slip are presented.

Improvements in Placing of General Ware.

By Gordon Klein, *New Castle Refractories Co.*, New Castle, Pa.

North Carolina Cornwall Stone.

By J. H. Weis, *United Feldspar Corp., 10 East 40th St.*, New York, N. Y.

Analytical descriptions are given of feldspars available in North Carolina to show the possibilities of producing material similar in composition to English Cornwall stone.

North Carolina Cornwall Stone as a Substitute for English Cornwall Stone in Whiteware Bodies.

By George A. Wills, *Dept. of Ceramics, University of North Carolina*, Raleigh, N. C.

Large reserves of material of approximately the same geologic character and chemical composition as English Cornwall stone have been developed in western North Carolina. A comparative test was made of the English and North Carolina material to see if their working and firing properties were the same. The results indicate that North Carolina Cornwall stone can be substituted for the English Cornwall stone in equal amounts. The results include a range of firing up the cone 15.

Notes on a Cone 10 Raw Crystal Glaze.

By H. Thiemecke, *Westinghouse Electric & Mfg. Co.*, Pittsburgh, Pa.

Report on Work of the Advisory Committee to the Bureau of Standards.

By F. P. Hall, *Onondaga Pottery Co.*, Syracuse, N. Y.

Business session of the White Wares Division.

HOBART M. KRANER

TWO ADDITIONAL REASONS WHY THE 36TH ANNUAL MEETING WILL BE A SUCCESS

These two reasons are Dr. Frank R. Henry of Simonds Worden White Company of Dayton, Ohio, and Hobart M. Kraner of Corhart Refractories Company, Louisville, Ky., two members of the Administrative Committee.

DR. FRANK R. HENRY

PROGRAM SCHEDULE

THIRTY-SIXTH ANNUAL MEETING, HOTEL NETHERLAND PLAZA CINCINNATI, OHIO

	Sunday February 11	Monday February 12	Tuesday February 13	Wednesday February 14	Thursday February 15	Friday February 16
FORENOON	*Registration*	9:00 General Session Ceramic Design (Hall of Mirrors)	Division meetings both forenoon and afternoon Eight meetings held simultaneously both days		9:30 (1) Symposium on Thermal Conductivity (Rooms A-B-C-D) (2) All day trip to Armco and Frigidaire for Enamel Division	All day Louisville Trip. All Divisions guests of Standard Sanitary Corhart Refractories Louisville Enamel Louisville Pottery
NOON		Committee Luncheons	General Luncheon (Hall of Mirrors)	Division luncheons	For all other than enamelers this afternoon will be devoted to tours to Cincinnati's points of interest (1) Newport Rolling Mill (2) Rookwood (3) John Douglas (4) Cambridge-Wheatley (5) University (6) Art Gallery, Union Terminal 2:00 Board of Trustees (Room G)	This will be a delightful and informing trip. Returning to Cincinnati early in evening
AFTERNOON	*Registration* (1) Meeting of Board of Trustees (Room G) (2) Editorial Committees with Publications Committee (Room J) (3) Standards Committee (Room A)	2:00 General Session Ceramic Design (Hall of Mirrors)	*Room Assignments* *Division* — *Room* Art — E-F Enamel — Pavillon Caprice Glass — A-B-C-D Materials and Equipment — G Refractories — North Exhibit Hall Structural Clay — Caprice Alcove Terra Cotta — E-F White Wares — South Exhibit Hall			
NIGHT	8:00 President's Reception 9:00 Musicale (Hall of Mirrors)	6:30 (1) Keramos Dinner Meeting (Rooms A-B-C-D) 9:00 (2) Ceramic "Ruckus" (Hall of Mirrors)	8:00 (1) Edward Orton, Jr., Lecture by Dr. A. L. Day (Hall of Mirrors) (2) Thirty-Fifth Anniversary Honoring of Charter Members (3) Reception to Students	5:00 Enamelers Trip-Newport Rolling Mill 6:00 Fellows Business-Dinner Meeting (Hall of Mirrors) 9:00 Dance (Pavillon Caprice)	8:00 Lecture by Dr. Geo. W. Morey joint auspices of American Chemical Society and American Ceramic Society (Hall of Mirrors)	

LADIES ENTERTAINMENT AT THE CINCINNATI MEETING

Mrs. Richard B. Carothers, *Chairlady*

1. Headquarters all week: Empire Dining Room (Room H)
2. Tuesday Afternoon, 4 P.M.: Tea.
3. Wednesday Afternoon: Sightseeing tour to Taft Museum—Union Terminal—Rookwood Pottery.

Your family will enjoy the hospitality of these southern hostesses.

THE NEWPORT ROLLING MILL COMPANY and THE ANDREWS STEEL COMPANY

Wednesday Night, 5:00 to 9:00 P.M.

These companies will be hosts on Wednesday night to all those who wish to see rolling mills in operation. Dinner will be served.

No more spectacular and favorable time than at night to see steel poured and rolled.

Sam, the "Nameling Man" promises to "do his best" on this occasion.

WHAT IS A CERAMIC "RUCKUS"?

You won't know until the Cincinnati Committee shows you on Monday night at the Annual Meeting—and how!

Hall of Mirrors

They will shoot the china plates, and Dick Carothers will be ring master and referee—'nough said.

Dancing and fun, rather than a banquet and speeches!

TWO FORMAL ILLUSTRATED LECTURES 36TH ANNUAL MEETING PROGRAM BY THE GEOPHYSICAL LABORATORY STAFF MEMBERS

1. Dr. Arthur L. Day, on Tuesday night at 8 o'clock in Hall of Mirrors. The Edward Orton, Jr. Memorial Lecture. Subject: Natural and Artificial Ceramic Products.

2. Dr. George Washington Morey, on Thursday night at 8 o'clock in Hall of Mirrors. Joint meeting of the Cincinnati Section of the American Chemical Society and the American Ceramic Society. Subject: Glass, the Bond in Ceramics.

THE GEOPHYSICAL LABORATORY

During the Cincinnati Meeting of the American Ceramic Society there will be two general evening sessions at which lectures will be given. One of these will be the Orton Lecture under the auspices of the Board of Fellows and the other a lecture before a joint meeting with the Cincinnati Section of the American Chemical Society. By a coincidence the speakers happen to be from the same institution. The Orton Lecture will be given by Dr. Day, Director of the Geophysical Laboratory, and the joint meeting will be addressed by one of his colleagues, Dr. Morey. A brief statement of the varied activities of this internationally famous laboratory and some indication of the relation of these activities to ceramics may therefore prove of interest.

The immediate forerunner of the Geophysical Laboratory was the Physical Laboratory of the United States Geological Survey, with which the names of such eminent scientists as Becker, Barus, and Hallock are associated. This laboratory had done extremely valuable pioneering research in high-temperature technique; in the field of rigidity and viscosity; and in fields of even more direct interest to ceramists, investigations such as the effects of water on glass at elevated temperatures and pressures, and a study of strain in the well-known Prince Rupert drops. Unfortunately, these investigations were interrupted in 1892 by the discontinuance of governmental appropriations. In 1900, however, Dr. Becker was enabled to reëstablish his laboratory and called to his assistance an American physicist, Dr. Arthur L. Day, who, for several years, had been on the scientific staff of the Physikalische Technische Reichsanstalt, the first American to achieve this unusual distinction.

In 1904 the appropriations for the studies undertaken by the Physical Laboratory of the Survey were augmented by a grant from the Carnegie Institution of Washington. The classic work of Day and Allen on the "Isomorphism and Thermal Properties of the Feldspars," which followed as a result of this coöperative effort, may properly be considered as the first of an imposing list of some eight hundred papers on the physics and chemistry of minerals and their systems published by the Geophysical Laboratory, many of which are of fundamental importance to us as ceramists. Strictly speaking, however, this Laboratory, as one of the major activities of the Carnegie Institution of Washington, was founded a year or two later.

If we consider that ceramic products are the result of fire on earthy materials—a definition, by the way, that Dr. Day assisted in formulating—the intimate relation between geologic and ceramic processes is readily apparent.

"Geology," to quote Dr. Becker in his introduction to the paper on feldspars mentioned above, "is not a science, but the applications of the sciences to the elucidation of the history of the earth." From the paper which followed we may take the words of Day and Allen:

> Geological field research is essentially a study of natural end-phenomena, of completed reactions, with but a very imperfect record of the earlier, intermediate steps in the earth-making processes. The records of the splendid laboratory experiments which have already been made are also of this character. The final end-product has been carefully studied, but the temperatures at which particular minerals have separated out of the artificial magma and the conditions of equilibrium before and after such separation have not been determined.

The Geophysical Laboratory, situated on a beautiful hill overlooking Rock Creek Park in the District of Columbia has an environment ideal for research.

The statements just quoted could, with equal truth, be paraphrased readily to describe much of the experimentation in ceramics as carried out in the period under discussion. Contrast this picture with the program of the Geophysical Laboratory:

> Our plan on entering this field was to study the thermal behavior of some of the simple rock-forming minerals by a trustworthy method, then the conditions of equilibrium for simple combinations of these, and thus to reach a sound basis for the study of rock formation. . . . Eventually . . . our knowledge of the rock-forming minerals should become sufficient to enable us to classify many of the earth-

making processes in their proper place with the quantitative physico-chemical reactions of the laboratory.

Furthermore, in these quantitative studies an exceptionally high ideal was set, to attain: " . . . the same order of accuracy that is expected in more strictly physical investigations." Qualitative studies of minerals and their interrelations leading to conclusions tinged with uncertainty, or, at times, actually misleading, were to be supplemented by quantitative determinations of the highest possible accuracy: surely a radical step in attacking geologic problems.

The successful solution of complex problems requires balanced coördination of activity. The correlation of effort in the Geophysical Laboratory was simple and effective:

. . . chemistry must guarantee the initial purity of the component minerals, physics must provide and measure the temperatures and pressures, physical chemistry must correlate the reactions, and petrology must fit the product into its proper niche in the earth's rock system. This, in a word, is the Geophysical Laboratory organization.

In the initial stages of the execution of this plan the practical value to metallurgy and ceramics of by-products of such research was recognized. Again quoting from an early annual report:

It is interesting to note the continual cropping out of technical problems at every stage of the process. The development of a pure ferrous silicate has already been shown to involve the relation of pure iron to its oxides and to reducing agents, while the study of lime-silica mixtures is fundamental in the preparation of Portland cement. Questions of technical interest in glass manufactures reappear everywhere in handling silicate solutions.

In another annual report, sometime later, the Director noted

. . . that in the ceramic, glassmaking, and allied industries these methods of combined physico-chemical and microscopical research are attracting inquiry and are being gradually adopted. In particular, the petrographic microscope has proved to be a most efficient and simple tool in the service of such industrial research and its use is certain to become increasingly important as this fact is realized by the technical world.*

These by-products of research have enriched our knowledge of fundamentals on which ceramics is based. Indeed the results on mineral systems published by the Geophysical Laboratory represent by far the greatest proportion of the available authoritative information fundamental to ceramics. We have appropriately recognized these outstanding accomplishments of such great value to the ceramic industry by having conferred Honorary Membership in the American Ceramic Society upon the Director of the Geophysical Laboratory. The Society and the Fellowship are indeed honored in having Dr. Day accept the invitation to deliver the Orton Lecture for 1934.

After some years of preliminary work on high-temperature technique, including the extension of the platinum-platinum rhodium thermoelement scale to the melting point of platinum, the development of electric furnaces, the determination of silicate melting points by means of thermoelements, combined with the petrographic study of "quenched" charges, and the development of "bomb" furnaces for investigating silicate melts under pressure in contact with water vapor, it was satisfactorily demonstrated that mineral systems could be quantitatively studied in the laboratory and equilibrium conditions determined. In accordance with the original plan, the first minerals to be investigated were simple two-component systems, such as lime–silica, lime–alumina, and silica–alumina. After the technique had been sufficiently developed a three-component system was investigated and the temperature-composition phase equilibrium relationships were determined for lime–alumina–silica. The data developed by this research, the first strictly quantitative study of its kind, fundamentally underlie silica refractories, silica-aluminous refractories, and Portland cement clinker. This research, during eight years of continued effort, required over a thousand mineral preparations on which some seven thousand heat treatments and microscopical examinations were undertaken. Considering the pioneering nature of this investigation, its successful culmination was indeed a remarkable scientific feat and a fine tribute to the skill, ingenuity, and perseverance of the researchers.

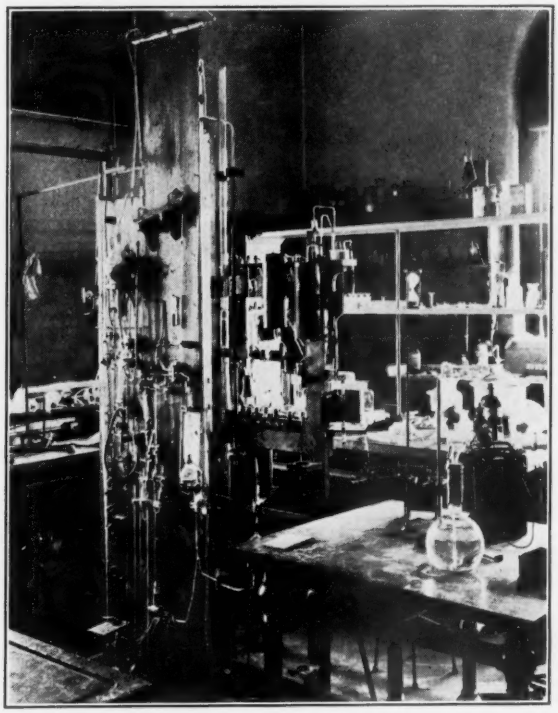
Collecting volcanic gases from a lava cone in the crater of Kilauea.

The next step in the plan of the Geophysical Laboratory was to apply, if possible, the same type of quantitative research to the study of volcanoes, for "volcanoes offer the only opportunity now remaining to science to study the phenomena accompanying the formation of igneous rocks in nature, and by far the greater portion of these must remain entirely inaccessible to man because of the violence of their activity." It was, therefore, with considerable gratification that the Director was enabled to report:

Perhaps for the first time in the history of volcano observation, laboratory-trained men have stood upon the brink of an active volcano basin, fully equipped to measure the temperature distribution prevailing down in the boiling

* The reader is referred to *Trans. Amer. Ceram. Soc.*, **15,** 48–53 (1913) for a comparison of method and purpose in attacking geologic and ceramic problems.

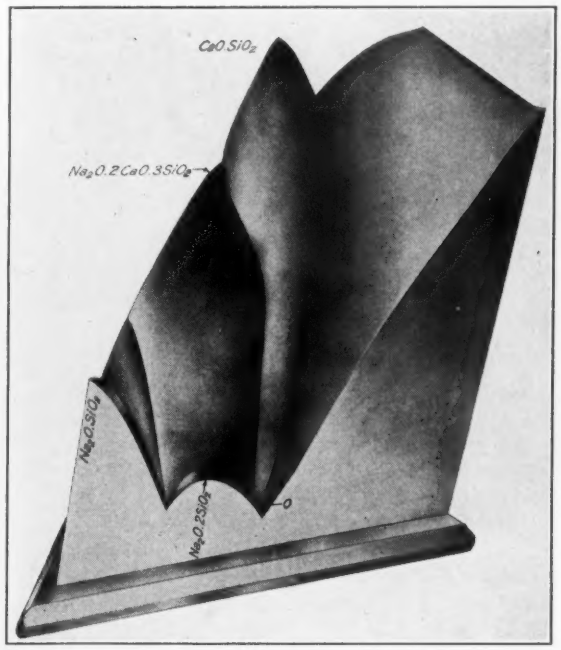
lava at their feet and to collect appropriate samples both of the liquid and gaseous ingredients which through their inter-reactions so largely determine the character of volcanic phenomena. . . . the opportunity presented this year was a rare one and the fact that trained men and appropriate facilities were on the ground to take advantage of it forms one of the bright pages in the history of this elusive science.



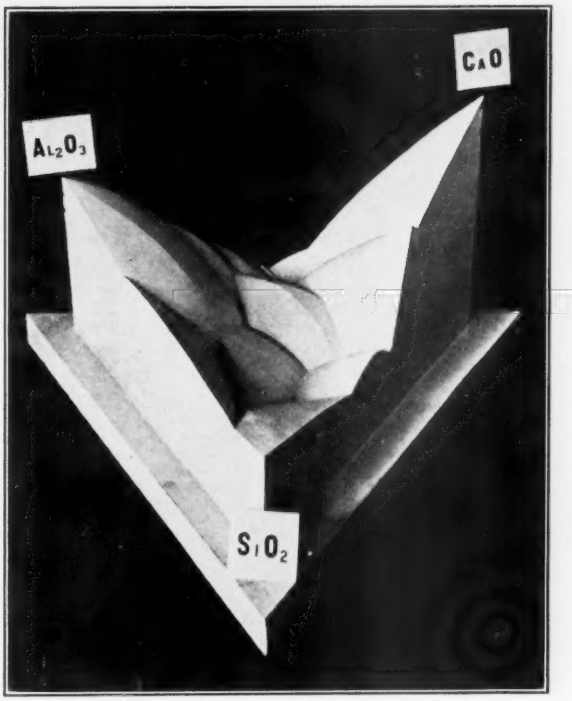
Apparatus for analyzing gases, collected as such from volcanoes, or extracted from volcanic rocks or commercially melted glasses.

In many of these expeditions Dr. Day has taken an active part, sharing hardship and danger with his colleagues. It is no child's task to climb down into a crater, with a cumbersome pack of instruments and equipment, to the edge of the seething lava; loose footing would cause a plunge to hot rocks below, or a shift of wind currents would cause suffocation by poisonous fumes. It is this type of experience, obtained first-hand, that has equipped our next Orton Lecturer for his discussion of "natural ceramic" processes and products.

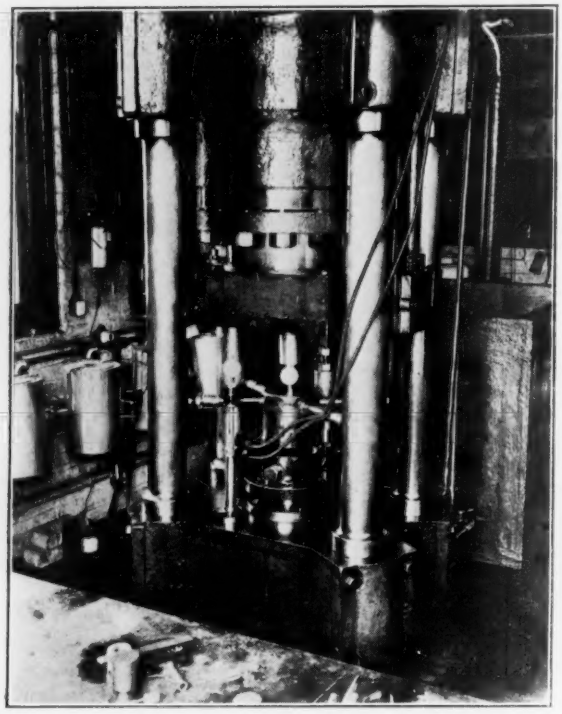
Reference already has been made to mineral systems of interest and value to the refractory technologists. But of equal importance and value is the fundamental work on glass compositions, annealing, and process, developed by the staff of the Geophysical Laboratory as a result of their activity in producing optical glass under the stress of war. Enough has been stated regarding the extensive knowledge of high-temperature technique in handling silicates developed in this laboratory to show that at the beginning of the War there was available here a rather unique collection of knowledge and skill in silicate research not found elsewhere. It was quite logical, therefore, that the National Research Council should ask the President of the Carnegie Institution of Washington to allow the



The system $Na_2O{\cdot}SiO_2$–$CaO{\cdot}SiO_2$–SiO_2 giving the fundamental relations underlying commercial lime glasses (after Morey and Bowen).



The system: Lime–alumina–silica. This space model gives the composition-temperature equilibrium conditions underlying silica refractories, silica-aluminous refractories, and Portland cement clinker. (From original data of Shepherd, Rankin, and Wright.)



High-pressure equipment, capable of producing pressures of 60,000 pounds per square inch, at 1600°C, or 300,000 pounds per square inch at ordinary temperatures.

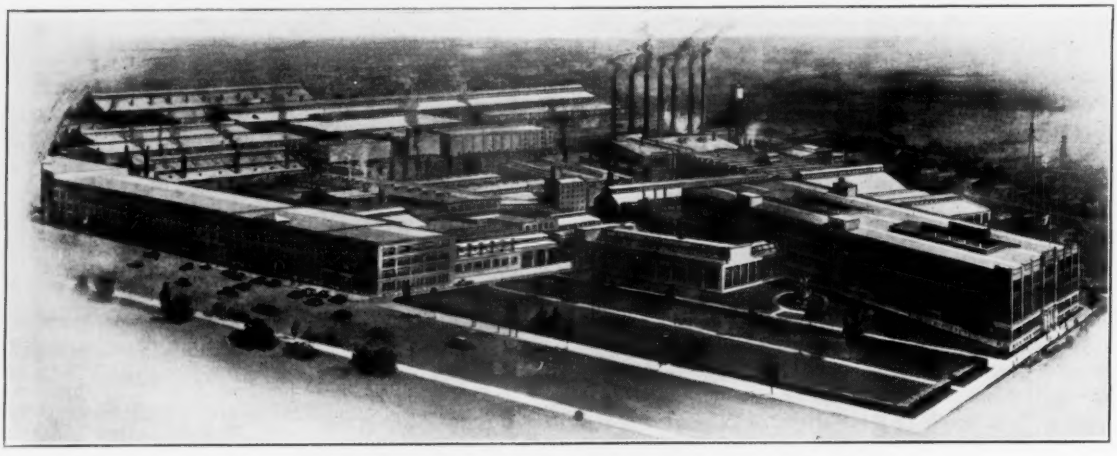
resources of the Geophysical Laboratory, both in men and apparatus, to be applied to the task of providing optical glass for the American forces. The history of this successful effort is a matter of record and it is not necessary to discuss details here. The interesting developments accomplished in this undertaking included a correlation of chemical compositions with optical properties, an improved method by Dr. Morey for making optical glass that cut the time factor in half, and an understanding of strain and annealing that removed the mystery from this process and reduced it to a definite time-temperature cycle. These studies, reduced to practice during the War, were afterward elaborated and published, in large part, in the *Journal of the American Ceramic Society*. Since then certain studies of mutual interest to geophysics and glass technology have been continued, in particular that of the system soda–lime–silica, which gives the composition-temperature equilibria and establishes for the first time the fundamental reasons underlying commercial glasses. These important studies on the fundamentals of glass have been carried out primarily by Dr. Morey and his colleagues. This fund of specialized knowledge accumulated during some twenty years of research at the Geophysical Laboratory amply qualifies him for his task of addressing us on "Glass, the Bond in Ceramics."

This outline is an altogether too brief and a far from complete story of the accomplishments of the Geophysical Laboratory. It is hoped, however, that sufficient material has been touched upon to give an insight to the rather unusual research experience that these scientists will bring to us.

As ceramists the members of our Society have to do with a wide range of products but fundamentally our mutual interests are developed through the action of fire on earthy materials. Dr. Day will correlate our work with that of nature; Dr. Morey will show us that it is the vitreous phase that binds us together. J. C. H.

THAT IMPORTANT LOUISVILLE TRIP, FRIDAY, FEBRUARY 16

8:00 A.M. (E.S.T.) Leave Cincinnati
10:00 A.M. (C.S.T.) Arrive Louisville
10:00–12:00 M. Visit Corhart Refractories Company
12:00–1:00 P.M. Buffet Lunch—Compliments Cohart Refractories Company
1:00–2:30 P.M. Visit Standard Sanitary Manufacturing Company
2:30–4:30 P.M. Party separates temporarily to visit
(1) American Medicinal Spirits Company
(2) Louisville Enameled Products Company
(3) Louisville Pottery Company
4:30–7:30 P.M. Return to Cincinnati.



Standard Sanitary Manufacturing Company, Louisville Works.

LOCAL SECTION NEWS

Pittsburgh Section

Harold E. White of Lava Crucible Company, Zelienople, Pa., was elected Chairman of the Pittsburgh Section at the meeting held on December 12, 1933. Mr. White also serves the American Ceramic Society as Vice-Chairman of the Refractories Division and as a member of the Editorial Committee for that Division.

The other Pittsburgh Section officers elected at this meeting are as follows:

Vice-Chairman: Raymond E. Birch, *Harbison-Walker Refractories Co.*, Pittsburgh, Pa.
Treasurer: Jack H. Waggoner, *Mellon Institute*, Pittsburgh, Pa.
Secretary: R. F. Ferguson, *Technical Products Co.*, Sharpsburgh Sta., Pittsburgh, Pa.

The meeting was held in Thaw Hall, University of Pittsburgh, where Alexander Silverman delivered a lecture on the Silverman Glass Collection. The Silverman Glass Collection to which new pieces are being added from time to time is said to be the foremost collection of glass from the standpoint of art and technology. Lantern slides and colored motion pictures were shown in addition to the actual glass exhibit.

On November 14, Charles H. Herty, Jr., Director of the Carnegie Institute of Technology Mining and Metallurgical Boards, addressed the Pittsburgh Section on certain phases of his studies of open-hearth slags. Dr. Herty discussed the analysis of the slag, its alteration during all stages of the heat in a basic open hearth, and the effects of various chemical oxides.

When the meeting was thrown open for discussion, Dr. Herty dealt at some length with the findings of W. J. McCaughey and others whose work with open-hearth slag has more largely been concerned with their mineralogical composition. Dr. Herty has made an exhaustive study of ferrous slags and has done much of his work with combinations of the pure oxides. This work has lead to a number of publications on such subjects as (*a*) "Viscosity Relations in the $CaO–SiO_2$ System" (with F. A. Hartgen, U. S. Bur. Mines *Bulletin* No. 47, 1930), and (*b*) "The System $FeO–SiO_2$" (in collaboration with G. R. Fitterer, *Ind. Eng. Chem.*, January, 1929). This system studied by different methods later by the Geophysical Laboratory was published by N. L. Bowen and J. F. Schairer, *Amer. Jour. Sci.*, September, 1932). (Their diagram is reprinted on page 493 of the October, 1933, issue of the *Journal of the American Ceramic Society.*)

Herbert Insley, petrographer of the U. S. Bureau of Standards, Washington, D. C., addressed the January 9 meeting of the Pittsburgh Section.

Future Meetings Owing to the Annual Meeting of the American Ceramic Society in February, the Pittsburgh Section will not hold a February meeting.

At the March meeting Professor Leighton, Head of the Department of Geology of the University of Pittsburgh, will speak on the relation of geology to ceramics.

STUDENT BRANCHES

Rutgers University*

The Student Branch was formally organized in October with the following officers:

President: Chester Gulick.
Secretary: Walter Archbold.
Treasurer: Harry Barske.
Councillors: G. H. Brown and H. F. Vieweg.

The Program Committee was appointed and was instructed to secure speakers from the various branches of the industry for the coming meetings. It was decided to follow the usual practice of devoting one of the spring meetings to a program on ceramic art which would be open to the general public. A speaker of prominence in this field will be secured.

There are twenty active members at the present time. A number of the alumni have been returning for the meetings.

The November meeting was devoted to a discussion of the use of ceramic materials in the field of acoustics. John Parkinson of Johns-Manville presented an interesting talk covering the use of ceramics in improving the acoustic properties of public buildings, theaters, etc.

Leonard Briggs of Lenox, Inc., has been secured as the speaker for the January meeting.

Missouri School of Mines and Metallurgy†

The present officers of the Student Branch are as follows:

President: Robert L. Stone.
Vice-President: George Sellers.
Secretary-Treasurer: Oliver Kamper.

A temporary program for the year has been arranged.

January 10, 1934: Symposium on the geology and mining of the Harbison-Walker plant at Vandalia, Mo., by Dr. Muilenberg and Prof. Steinmesh.

January 24: Symposium of the plant operations at the A. P. Green Fire Brick plant at Mexico, Mo., by C. M. Dodd.

February 7: Lecture on fuller's earth by Mr. Farrar.

February 22: Motion picture on Champion spark plugs.

The senior class will attend the Annual Meeting of the American Ceramic Society in Cincinnati, February 11 to 16, as a part of the senior trip.

University of North Carolina

The officers are as follows:

President: Wm. Rex McLain.
Vice-President: D. L. Bohannon.
Secretary: J. B. Sauls.
Treasurer: H. M. Hamburger.

The attendance of the Student Branch this year has far exceeded that of the two past years. There is a great deal of enthusiasm in the society this year.

Programs have been planned for the remainder of the year. At each meeting a member of the school faculty will lecture on some phase of ceramic engineering. The entire senior class in ceramic engineering is planning to attend the Annual Meeting of the American Ceramic Society in Cincinnati in February.

* CHESTER GULICK, *President.*
† ROBERT STONE, *President.*

CLASSIFICATION OF FLORESCENCE*

By Ellis Lovejoy

FLORESCENCE

After McIntyre, *Trans. Ceram. Soc.* [Eng.]. The general phenomenon of crystallization of salts in their relation to clayware.

I. Cryptoflorescence

(After McIntyre.) Crystallization of salts below the surface of fired ware during long exposure to weather causing rupture of the bond and spalling of the surface.

(1) Originates in:
- (*a*) Uncombined salts in underfired ware.
- (*b*) Salts from disintegrating mineral silicates.
- (*c*) Salts absorbed from mortars and back-ups.

(2) *Correction:*
- (*a*) Hard firing to combine salts and strengthen bond.
- (*b*) Improved ware structure (lamination, vugs, large pores).
- (*c*) Selection of mortars.
- (*d*) Hard fired back-ups.

II. Efflorescence

A coating of soluble salts on the surface of clay bodies brought in solution from within or through the bodies by capillarity and deposited by evaporation.

(*A*) On unfired bodies.
- (1) Salts in clay appearing on cut banks of clay beds and upon dry ware surfaces.
- (2) Salts in pugging water (as in 1).
  Correction: 1 and 2.
  - (*a*) Selection of clay and water.
  - (*b*) Barium compounds (the only effective use of barium).
  - (*c*) Rapid drying.
- (3) Sulfate salts developed from clay minerals by sulfur gas in the drying atmosphere.
  Correction: eliminate the sulfur gases.

(*B*) On fired ware after exposure to weather. Generally recognized and designated (wall) efflorescence.
- (1) Salts from within the ware.
  - (*a*) Salts in the dry ware not combined in the firing.
  - (*b*) Sulfate salts developed from the minerals in the ware in the early stages of coal firing and subsequently not combined.
  - (*c*) Disintegration of weak mineral silicates in the fired ware (usually after placing in the wall).
  - (*d*) Colors.
    - (1) White, salts of *alkalis*, *magnesium*, calcium.
    - (2) Green, salts of *vanadium*, chromium, nickel, iron.
    - (3) Yellow, salts of *molybdenum*, vanadium.
    - (4) Brown, ferric oxide from ferric sulfate and perhaps vanadium acid ($H_4V_2O_7$).
- (5) *Correction:*
  - (*a*) Hard firing to combine salts and harden ware.
  - (*b*) Selection of clay to avoid green efflor. If clay is pyritic use unoxidized under-cover clay in preference to oxidized crop clay.
  - (*c*) White lead in clay minimizes green efflor.
  - (*d*) Dipping ware in potassium carbonate (1%) solution overcomes green efflor.
- (2) Salts from outside sources.
  - (*a*) Ground contacts absorbing ground salts.
    Correction: insulation.
  - (*b*) Contacts with sandstone and cast stone trims.
    Correction: insulation or elimination of trims.
  - (*c*) Salts from mortar, especially cement, and back-ups.
    Corrections (recommended): add stearates, colloidal clay, infusorial earth, barium carbonate to the mortar.
  - (*d*) Dripping from efflorescing trims.
    Correction: proper drips.
  - (*e*) Acidulated roof waters against parapet walls.
    Provide proper flashings.
  - (*f*) Copings of sandstone or cast stone.
    Use vitrified clayware with proper drip.
  - (*g*) Sulfur gas in chimneys.
    Use flue linings.
  - (*h*) Muriatic acid in cleaning walls intensifies green efflor.
    Use HNO_3 (5%) and H_2O_2 (5%) and immediately water-proof the wall.

III. Inflorescence

A white coating of soluble salts deposited on the surface of fired ware prior to constructional use, from sources outside the ware. (Differentiated from efflorescence which comes to the surface after weathering, from within or through the ware. Inflorescence is deposited on the surface shortly after firing, often during cooling.)

Usually quite evanescent. Alums and sodium chloride and some rare coatings.

The most common source is volatile salts from cooling furnace fire beds deposited on the ware during cooling.

Wet dirty coal, especially pillar coal, or wet storage coal is the chief cause of inflorescence.

IV. Scum

A dirty white complex insoluble coating on the surface of fired ware, developed in the firing from efflorescence on the dry ware.

(*A*) Some efflorescing salts.

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* Report from the Committee on Data, American Ceramic Society. Received Dec. 28, 1933.

(1) $CaCO_3$ [from $(CaHCO_3)_2$]; $CaCl_2 \cdot 6H_2O$; $CaSO_4 \cdot 2H_2O$.
(2) $MgCO_3 \cdot 3H_2O$; $MgCl_2 \cdot 6H_2O$; $MgSO_4 \cdot 2H_2O$.
(3) $K_2CO_3 \cdot 2H_2O$; $KHCO_3$; KCl; K_2SO_4; $KHSO_4$.
(4) $NaCO_3 \cdot 10H_2O$; $NaHCO_3$; NaCl; $Na_2SO_4 \cdot 10H_2O$; $NaHSO_4$.
(5) $KAl(SO_4)_2 \cdot 12H_2O$ and other alums.
Under fire some volatilize, others progressively dissociate.

(*B*) First steps toward scum.
(1) (A1 to A5) + H_2SO_4 (in coal firing) are converted into sulfates.
(2) Dehydration of salts at low temperatures.
(3) Dissociation of the salts to oxides at varying temperatures. Order of dissociation indefinite, in general. Alums (volatilize), copperas, potash and soda sulfates, magnesium sulfate, calcium sulfate.

(*C*) Second and final stage toward scum.
(1) Silica-oxide reactions on clay-coating contact progressively decimate the coating by combination; some combinations without notable effect on the ware color, others are white or light colored, notably lime silicate which is a chief factor in normal scum.
(2) Coating not contacting with clay; -fused alkalis ("fixed scum" after Palmer) and other fused residual salts; dead-burned lime and magnesia; silicides from soluble silica in the initial efflorescence.
(3) *Correction of scum.*
(*a*) Eliminate *efflorescence* on dry ware (II–A).
(*b*) Hard firing to effect combination.
(c) Reducing kiln atmospheres to aid combination.

NOTE: Vanadium and molybdenum which produce greens and yellows are not in evidence in scum.

ENAMEL DIVISION NOMINATING COMMITTEE REPORT

M. E. Manson, *Chairman*, and W. N. Harrison, *Secretary* of the Enamel Division, present the report of the Nominating Committee of this Division for the officers for 1934–1935.

These officers will be balloted on at the business session of the Enamel Division at the Annual Meeting in Cincinnati.

Chairman, W. N. Harrison, Bureau of Standards, Washington, D. C.
Secretary, B. J. Sweo, Bureau of Standards, Washington, D. C.

Nominating Committee
Erwin Sohn, Standard Sanitary Mfg. Co., Louisville, Ky.
B. T. Sweely, Chicago Vitreous Enamel Products Co., Cicero, Ill.

Councillors
Frank Hodek, Chicago, Ill.
Robert Schaal, Roberts and Mander Co., Hatboro, Pa.

ERRATA

The Bulletin, **12** [12], 344 (1933). Under caption "Officers to be Ballotted on for 1934," the Company name for W. Keith McAfee should read Universal Sanitary Manufacturing Company.

The Bulletin, **12** [12], 352 (1933). Under photograph of Fred S. Thompson, the address of the Corhart Refractories Company should read Louisville, Ky.

WIN WITH WISDOM

Wise is he who earns and secures the aid of others. Promotion of the ceramic arts and sciences is a coöperative task; the more who are coöperating, the more successful will be the promotion.

NEW MEMBERS RECEIVED IN DECEMBER

CORPORATION

Isolantite, Inc., R. S. Bicknell (voter), 343 Cortlandt St., Belleville, N. J.

PERSONAL

Elliott C. Aydelott, 151 Lexington Ave., Dayton, Ohio; Porcelain Enamel Dept., Frigidaire Corp.
Arol Hall, 1009 N. Webster, Kokomo, Ind.; Enamel Department, Globe American Corp.
Paul M. Offill, 702 Fulton Bldg., Pittsburgh, Pa.; Vice-President, Amsler-Morton Co., Inc.
Robert A. Williams, Jr., Franklin Tile Co., Lansdale, Pa.

STUDENT

William S. Debenham, University of Illinois.
Harry J. Robinson, Ohio State University
Kenneth G. Skinner, University of Washington.

Membership Workers' Record

CORPORATION		STUDENT	
E. H. Fritz	1	A. J. Metzger	1
PERSONAL		C. W. Parmelee	1
P. L. Geer	1	Hewitt Wilson	1
Office	3		
	—	Total	3
Total	5	Grand Total	8

Another Message From the Membership Committee

A Form of Investment Which is Tax-Exempt and "Depression-Proof"

is now available to those interested in the ceramic and allied industries. Would it not be wise to avail yourself of such an opportunity?

Obviously, the only "sure thing" is an investment in knowledge and experience. Some people can, without referring to the experiences of others, accumulate a considerable store of information in the course of a lifetime. Such people are indeed a rarity. It is not safe to assume that you belong to such a group, since the odds are against any such probability. Even if you are one of the fortunate few, a lifetime is a considerable time to spend at problems which could be solved in a relatively short time by a simple reference to the literature on the subject. Only by having a clearing house for the knowledge, experience, and information accumulated by many minds can continued progress be assured in any line of endeavor.

The advantages of belonging to the American Ceramic Society have been set forth at various times in appeals from the Membership Committee. These should be apparent to any thinking person. Let us look at the other side of the picture. If you are occupied in any ceramic or allied industry, whether as employer or employee, it is reasonably safe to assume that a good proportion of your success is due to the efforts of the American Ceramic Society to further the advance of the industry through the publications of this Society. The Society will continue to work in your behalf, placing at your disposal the latest scientific developments in your field. Would it not be wise to lend this organization your whole-hearted support?

The American Ceramic Society needs you as a member. You need and MUST HAVE what the Society has to offer.

Corporation Membership $25.00
Individual Membership $10.00

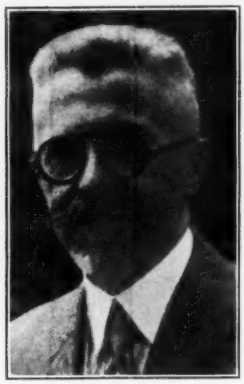
WIN WITH WISDOM

NECROLOGY

J. W. Wenning

Word has been received of the death of J. W. Wenning of New Brighton, Pa., on November 8, 1933. Mr. Wenning was born in Oberhausen, Germany, where he received his early training and education. At the age of eighteen he entered the enamelware business in the employment of the Rhenania Consolidated Enameling Works Corporation at Schwelm. He became manager of this plant and later was transferred to the Cologne plant where he had complete charge of production.

While in Cologne, he became interested in the manufacture of tin oxide and he operated a tin oxide plant for several years. This interest in chemicals and enamels finally brought him to one of Germany's most progressive chemical and color manufacturers, Rickmann and Rappe, where he conducted research on antimony enamels. Here he developed sodium antimonate and its application in steel and cast-iron enamels. While he was employed with Rickmann and Rappe he also studied the manufacture of coloring oxides for enamels, glassware, and pottery.



J. W. WENNING

In 1905 he came to the United States to build a chemical plant in Pittsburgh. Although he had only a limited capital, this plant grew under his management. In 1927 he organized the Ceramic Color and Chemical Mfg. Co.

Mr. Wenning has been a member of the American Ceramic Society since 1923. His son, W. F. Wenning, who has been a member of this Society since 1921 had been carrying on the active work of his father's business for more than a year before his father's death.

Henry Howell Baumgartner

George A. Balz has notified members of the American Ceramic Society of the death on November 16, 1933, of Henry Howell Baumgartner, following an automobile accident sustained last summer. Mr. Baumgartner was president of the Essex Engineering Company and made his home in Belleville, N. J. He became affiliated with the American Ceramic Society in 1932.

Robert A. Bautz

Robert A. Bautz, member of the American Ceramic Society since 1921 died at the Edgewater Hospital, Chicago, Illinois, on December 13, 1933. Mr. Bautz held a position of prominence in the mineral industry for many years. At the time of his death he was located at 235 North Clark Street, Chicago, Illinois, conducting research and as a producer of nonmetallic mineral pigments.

W. A. Howell

Word has been received from J. E. Enright that W. A. Howell, president and general manager of the Collingwood Brick & Clay Company, Toledo, Ohio, died on October 8, 1933. Mr. Howell became a member of the American Ceramic Society in 1929.

W. M. Jacobs

W. M. Jacobs of the Pittsburgh Plate Glass Company passed away on May 30, 1933. Mr. Jacobs who lived at 550 N. McKean Avenue, Kittanning, Pa., had been affiliated with the American Ceramic Society since 1915 and became an active member in 1919.

PAUL EMERSON TITSWORTH

Paul E. Titsworth, president of the New York State College of Ceramics and Alfred University died suddenly of a heart attack on the morning of December 10, 1933. Dr. Titsworth had gone to his garage preparing to leave for Hornell, N. Y., where he was to speak in the Christ Episcopal Church.

Born in Ashaway, Rhode Island, May 31, 1881, he spent his boyhood in Alfred and attended Alfred Academy and Alfred University. He was an honor graduate of the University in 1904 and later a professor of modern languages and dean of the college of liberal arts at Alfred.

Dr. Titsworth this year was called to the presidency of the New York State College of Ceramics and Alfred University from a similar position at Washington College, Chestertown, Md., to succeed Boothe C. Davis, who was head of Alfred for thirty-eight years.

After graduation from Alfred, Dr. Titsworth took postgraduate work at Ohio State University and the University of Wisconsin, receiving the degree of doctor of philosophy at the University of Wisconsin. He also studied in Berlin and Dresden. Returning to Alfred as instructor and later professor of modern languages, he was appointed dean of the College of Liberal Arts in 1921.

Career Is Reviewed

In 1923 he was elected president of Washington College, Chestertown, Md., where he raised the institution to a high rank in the association of colleges of the Middle Atlantic States. He was author of the Bibliography of Modern Languages for high school teachers and co-translator from the French of the Emancipation of Medieval Towns.

Dr. Titsworth was the founder and first president of the Rotary Club in Chestertown, and governor of the 34th Rotary District, comprising Maryland, District of Columbia, and parts of West Virginia and Pennsylvania. He also was one of two American members of Rotary's international service committee and was an American representative at the international convention in Vienna.

He served as president of the Kent County (Md.) Chamber of Commerce before coming to Alfred this year. Surviving are his wife, Vida Stillman Titsworth, three daughters, Elizabeth, at home, Eleanor Titsworth of Baltimore, and Katharine, and a sister, Miss Helen Titsworth of Lawrence, Kan.

PAUL E. TITSWORTH

President Alfred University and New York State College of Ceramics, July 1, 1933 to Dec. 10, 1933.

Funeral Services in Alfred

A private funeral service was held at the family home on December 13. The Rev. James C. McLeod, chaplain of the University, was in charge of the services, assisted by the Rev. Clyde Ehret, pastor of the church.

Burial was made in Alfred Cemetery, overlooking the little village where the educator played as a boy, taught as a professor, and to which he returned as head of the University after building a national reputation in his profession.

Tributes to Dr. Titsworth

Dr. Hostetter, president of the American Ceramic Society, attended President Titsworth's funeral, respresenting the American Ceramic Society.

Major E. Holmes, dean of the New York State College of Ceramics at Alfred has written the following tribute to Dr. Titsworth.

"I never met Dr. Titsworth until last July, but in five months time I came to feel that I had known him for a lifetime, and to find him one of the wisest men I ever knew. He undertook a very difficult task at Alfred University, that of filling the place of President Davis. He very wisely refused to take any suggestions or recommendations from any one as to his policies and methods. He posed as an observer of the status of affairs and then analyzed and acted upon the situation in his own way. At the time of his death it was evident that he had the situation perfectly in hand and the whole institution was running smoothly, with no friction, and without sabotage on the part of any one. His passing was a great loss to Alfred University."

Dean J. Nelson Norwood in commenting on Dr. Titsworth's loss made the following statement:

"President Titsworth had won golden opinions from faculty and students. He had great plans for the improvement of our educational system. I have known him for thirty-three years and was delighted when he was chosen president. This is a terrible blow to us all."

Assistant Dean I. A. Conroe has also paid tribute to Dr. Titsworth.

"Our feeling of loss is the greater because we have been privileged to glimpse the future in store for Alfred under the guidance of this man of vigorous personality and immense breadth of vision. His dream for Alfred will yet be fulfilled because of his brief sojourn among us as the University's fifth president."

Dean Norwood Appointed Acting President

On December 14, Dean J. Nelson Norwood of Alfred University was appointed Acting President by the Board of Trustees.

CERAMIC SCHOOL NOTES

Ohio State University

The November meeting of the Ohio State University Student Branch of the American Ceramic Society was held on November 21, 1933, in Lord Hall. C. Forrest Tefft, general manager of Claycraft Company in Columbus, the principal speaker at the meeting, talked on "A Survey of the Outlook for Ceramic Graduates in Industry." Professors Watts, Baggs, Carruthers, and King also gave short talks on the employment situation. "Some Ceramic Notables and Their Accomplishments," was discussed by Professor Watts, in which he recounted the progress of some of the early Ohio State ceramic graduates.

The following officers were elected to serve for the coming year:

President, John Herold
Vice-President, Everett Hite
Secretary-Treasurer, Philip Leider
Junior Representative to the Engineers' Council, Harry Robinson
Representative to the Ohio State Engineer, Robert Rea

Each year some piece of art ware is made by members of the Student Branch and this year ash trays, made by casting a sanitary ware body, were decided upon. Paul Herold and John Lannon are in charge of the project.

ENAMEL SHORT COURSE AT THE UNIVERSITY OF ILLINOIS

An Enamelers Short Course will be given by the Department of Ceramic Engineering at the University of Illinois from January 29 to February 2, 1934.

This course is designed primarily for the plant man who wishes to review or to add to his knowledge of enamel fundamentals. This course has been given every two years and has always met with much enthusiasm.

Visiting lecturers will be F. S. Markert, Ferro Enamel Corporation, Cleveland, Ohio, on "Firing and the Development of the Enamel Furnace"; E. P. Poste, Chattanooga, Tennessee, on "Enamel Tests"; and W. A. Darrah, Continental Industrial Engineers, Chicago, Illinois, on "Fuels and Combustion."

A complete list of the lectures is as follows:

(1) Raw Materials (3 lectures) by Professor Parmelee. Composition and properties of raw materials used in glazes and enamels and their influence on the development and characteristics of enamels. The lecture topics are (*a*) and (*b*) colorless materials, and (*c*) coloring of materials and opacifiers.

(2) Iron and Steel (2 lectures) by Mr. Howard. Relation of composition and properties and the manufacture of (*a*) cast iron and (*b*) sheet iron and steel.

(3) Metal Preparation (2 lectures) by Professor Andrews. Theory and practice of cleaning, scaling, pickling, and sandblasting of (*a*) sheet iron and steel, and (*b*) cast iron.

(4) Enamel Calculations (2 lectures) by Mr. Thompson. An explanation and practice in the calculations of batch melted weights, expansion, etc., (*a*) explanation of methods and (*b*) application of methods.

(5) Type Compositions and Limits (2 lectures) by Professor Andrews. Effects of variations in composition; the defects and causes: (*a*) compositions, and (*b*) variations and limits.

(6) Smelting (1 lecture) by Professor Andrews. The theory and practice of smelting sheet-steel and cast-iron enamels; a consideration of different types of smelters.

(7) Opacity (1 lecture) by Professor Andrews. The theory of opacity and the practical use of various opacifiers in sheet-steel and cast-iron enamels.

(8) Milling By Professor Andrews. Equipment, operation, and control will be considered.

(9) Mill Addition By Professor Andrews. Theory and practice of wet- and dry-process milling.

(10) Application of Enamels (1 lecture) by Professor Andrews. Considerations in the application of sheet-steel and cast-iron enamels.

(11) Firing and Enamel Furnaces (2 lectures) by Mr. Markert. Comparison of furnaces and equipment and the theory and practice of firing.

(12) Effects of Gases (1 lecture) by Professor Andrews. Effects of gases of combustion on the properties of vitreous enamels.

(13) Pyrometry (1 lecture) by Mr. Badger. General principles involved, apparatus used, and practical applications in the factory operations.

(14) Enamel Tests (1 lecture) by E. P. Poste. Control tests and tests for the finished product.

(15) Fuels and Combustion (1 lecture) by Mr. Darrah. Consideration of different types of fuels and their application in enameling furnaces.

(16) Refractories (1 lecture) by Professor Hursh. The characteristics of typical refractory materials and their adaptability to different types of service.

MIDWEST ENAMELERS SYMPOSIUM

In coöperation with the Chicago Enamelers Club, a Symposium will be held for enamelers on Saturday, February 3, following the Enamel Short Course.

At this Symposium, G. L. Clark will discuss the "Use of X-Ray in Enamel Research," E. P. Poste will discuss "Recent Developments in the Enameling Industry," and a discussion on "Chip-Proof Enamels," will be led by A. I. Andrews.

The Symposium will begin at 10 o'clock in the morning, followed by a noon luncheon and an afternoon session.

THE OPPORTUNITY OF THE BRICK INDUSTRY IN THE NEW HOME BUILDING PROGRAM

Discussion at Conference at the University of Illinois

The decline in building activity which began in 1926 and increased in intensity in 1930–1932 is showing signs of ending and a renewal of building, especially in homes, is about to begin. The home of the future will be moderately priced, well constructed, attractive, and conveniently arranged, and new materials will be used to a large extent to replace wood. The brick industry has an opportunity to share in a large measure in this building activity if the new conditions are clearly understood and the problems arising therefrom are satisfactorily solved. What some of these problems are will be discussed in an address which will be presented by W. H. Voskuil, Economist of the Illinois State Geological Survey, which will be presented with others at a Conference to be held during the Short Course in Structural Clay Products, University of Illinois, Urbana, Illinois, January 22 to 27, 1934.

CLAY PRODUCTS SHORT COURSE AT IOWA STATE COLLEGE, AMES, IOWA, JANUARY 24–26, 1934

Wednesday, January 24

9:00 A.M. Report on Test of Mortar Mixes
By J. C. Everds, Engineering Expt. Station, Iowa State College
Pumps for Vacuum on De-Airing Units
By H. R. Straight, Adel Clay Products Company, Redfield, Iowa
Rolls *vs.* Pan for Grinding Shale
By D. A. Moulton, Dept. of Ceramics, Iowa State College
(Data by G. Galvin, Rockford, Iowa)

1:00 P.M. Waste Prevention by Means of Safety and First Aid

Thursday, January 25

9:00 A.M. Efficiency in Handling Air for Clay Plants
By Bowen Campbell, Campbell Heating Company, Des Moines, Iowa
Study in Uniform Distribution of Air in Drying
By D. A. Moulton, Dept. of Ceramics, Iowa State College
Notes on Drying of Shales
By C. G. Harman, Dept. of Ceramics, Iowa State College

1:00 P.M. Demonstration of Possibilities of Laying Structural Tile and Brick
By W. P. Kapp, Goodwin Tile & Brick Co., Des Moines, Iowa

Friday, January 26

9:00 A.M. Salt Glazing of Vitrified Ware
By Frank Hodgdon, Ames, Iowa
Review of the Literature on Salt Glazing
By D. A. Moulton
Change from Oil to Natural Gas in a Haigh Type of Kiln
By L. Alt, Sioux City Brick & Tile Co., Sioux City, Iowa

1:00 P.M. Demonstration of a "Color Analyzer" machine
By the Physics Department of Iowa State College

ANNUAL MEETING OF THE CERAMIC ASSOCIATION OF NEW JERSEY

Rutgers University, December 19, 1933

The Annual Meeting of the Ceramic Association of New Jersey was held in the Ceramics Building, Rutgers University, New Brunswick, N. J., on December 19, 1933. The following program was offered.

(1) Specifications for White Ware Products
Discussion led by John R. Kauffman, Dept. of Ceramics, Rutgers University.
(2) Study of the Glass Phases Formed in Firing all Types of Ceramic Ware
By G. R. Shelton, Bureau of Standards, Washington, D. C.
(3) Methods of Determining Grain Size of Ceramic Raw Materials
By H. F. Vieweg, Dept. of Ceramics, Rutgers University.
(4) A Pictorial History of Glassmaking
By John C. Hostetter, Director, Development and Research, Corning Glass Works, Corning, N. Y. (and President of the American Ceramic Society).
(5) Discussion on The One-Fire *vs.* Two-FireProcess in, the Production of Vitreous Ware
Led by George H. Brown, Dept. of Ceramics Rutgers University.
(6) Discussion on Dust Elimination in Potteries.
(7) Business Session.

The officers of this Association during the past year have been J. M. Gilfillan, Trumball Electric Mfg. Co., Trenton, N. J., president; George Simcoe, Edgar Bros. Co., Metuchen, N. J., vice-president; Abel Hansen, Fords Porcelain Works, Perth Amboy, N. Y., councilor; and George H. Brown, Dept. of Ceramics, Rutgers University, secretary-treasurer.

NEW YORK CERAMIC STUDIOS ORGANIZED

Announcements have been received of the opening of the New York Ceramic Studios at 114 East 39th Street, New York City. Miss Maud M. Mason is director of the Studios, Mrs. Luther Locke Richardson, treasurer, and Mrs. Benjamin P. Vanderhoof, secretary.

This school has been organized to stimulate an appreciation of the art of ceramics and to afford students an opportunity to acquire a practical working knowledge of the art in its various phases. The course of study will include (1) the principles of design, (2) building, modeling, and decorating, (3) ceramic sculpture (in terra cotta and stoneware), (4) throwing and turning on the wheel, (5) mold making and casting, (6) theory and practice of colors, (7) composition of clay bodies, and (8) firing.

In addition to Miss Mason, the names of Waylande Gregory, William Soini, and H. Robert Bacher, appear on the staff of instructors.

A. P. GREEN IS HONORED

Allen P. Green, firebrick manufacturer of Mexico, Mo., was awarded the Degree of Doctor of Laws at the formal inauguration of Franc L. McCluer as President of Westminster College in Fulton, Mo., on October 28, 1933.

A. P. GREEN

Mr. Green is president of the A. P. Green Fire Brick Co., Mexico, and is a member of the Board of Trustees of the College.

He is chairman of the Liptak Furnace Arches, Ltd., London, England, and vice-president of the Bigelow-Liptak Corp., Detroit; is director of the Wabash Railway Co., of the Armstrong Cork Co., Lancaster, Pa., and is a director and vice-president of the Mexico Savings Bank. He is also a director, representing the Wabash Railroad, on the Western Railroads Commission, New York City.

Mr. Green has been affiliated with the American Ceramic Society since 1927, as corporation representative of his firm.

Mr. Green was born in Jefferson City 57 years ago and was reared there and in Sedalia, later attending the Rolla School of Mines, from which he graduated in Civil and Mining Engineering.

After graduation he worked as a construction engineer and became associated with the Harbison-Walker Refractories Company in 1900. He served in several capacities and in 1903 was made general sales manager and elected a director of the company. In 1905 he became associated with Evens and Howard as vice-president and general manager. In 1910 he purchased the then Mexico Brick and Fire Clay Company and has operated it as the A. P. Green Fire Brick Company since that time.

Mr. Green is now serving as a member of the Emergency National Committee of the refractories industry and is one ofthe five members of the National Control Committee and Industrial Control Committee of the industry

COLONEL FRED S. THOMPSON HONORED

Colonel Fred S. Thompson, thus he is now known by commission from the Kentucky governor. It will be one for you on Fred when you visit Corhart Refractories, Louisville, Ky., on Friday of the Annual Meeting.

"Win With Wisdom"

PRESENTATION OF CHEMICAL INDUSTRY MEDAL TO JAMES G. VAIL

The new Chemical Industry Medal of the American Section of the Society of Chemical Industry was presented November 3 to James G. Vail of the Philadelphia Quartz Company at a meeting held at the Chemists' Club, New York, N. Y. The meeting was held jointly with the American Chemical Society, the Electrochemical Society, and the Société de Chimie Industrielle.

The Chemical Industry Medal is an honor instituted this year by the Society of Chemical Industry for award annually to a person making a valuable application of chemical research to industry. Mr. Vail is the first recipient of this award, in recognition of his work on sodium silicates in industry. Walter T. Taggart described the work and accomplishments of Mr. Vail leading to this award. Marston T. Bogert of Columbia University, a past-president of the Society of Chemical Industry, made the presentation of the medal. Mr. Vail then gave an address on the subject of water-glass entitled "The Culture of Certain Silicate Gardens."

James G. Vail became a member of the Chemical Department of the Philadelphia Quartz Company in 1905. Since that date he has held numerous offices in this organization and is now a Vice-President and Chemical Director.

He was graduated from Westtown School in 1904 and for a number of years he has served on its Executive Committee. He continued his studies as a special student at the Technische Hochschule at Darmstadt, the University of Pennsylvania, and Harvard University.

Aside from his chemical work, Mr. Vail served with the American Friends Service Committee for the relief of famine in Germany in 1919–1920. He was in charge of the receipt and distribution of supplies and the feeding of children in the Hamburg District.

In technical circles he is well known due to his activity in American scientific organizations and through his many contacts abroad. He has served on the Executive Committee of the American Section of the Society of Chemical Industry, as Chairman of the Detergents Committee of the American Oil Chemists Society, as a Director of the American Institute of Chemical Engineers, and as Director of the Industrial Division and Chairman of the Philadelphia Section of the American Chemical Society. He is an active member of the Franklin Institute and is also a member of the American Ceramic Society and of various other technical and trade associations.

As the author of the American Chemical Society Monograph, Soluble Silicates in Industry, he is recognized as the leading authority on this subject. Although a great many articles dealing with the technology of the various forms of sodium silicate and the methods by which silicate is made to serve industry are credited to Mr. Vail, he has steadfastly refused to write for publication except when he felt he had something of importance to say. Recognition of his knowledge and ability has brought invitations to lecture before many scientific meetings, and his willing coöperation in solving a wide variety of educational and industrial problems has won for him world-wide friendship and respect.

HONORING COLIN G. FINK, SECRETARY OF THE ELECTROCHEMICAL SOCIETY

Colin G. Fink, Professor of Electrochemistry at Columbia University, has been elected to receive the Perkin Medal of the Society of Chemical Industry for 1934. The medal is awarded annually for valuable work in applied chemistry and will be presented this year to Dr. Fink for his inventions in the fields of metallurgy and electrochemistry. The selection is made by a committee representative of five of the national chemical societies.

TARIFF RULING ON ART GLASS

Among specimens brought from Europe in 1930 for his collection by Alexander Silverman, University of Pittsburgh, were four original works of art on which duty had to be paid. These included two original decorations of Marcel Goupy, famous enameler of France, an original engraving by Gallé, and an original deep etching by Daum. A protest was entered in the United States Customs Court for the recovery of the duty on the assumption that original works of art, of which not more than three copies have been prepared, can enter the United States duty-free in fields other than glass, namely, painting and sculpture. The following decision was rendered by the Customs Court in July, 1933:

Works of Art—Glass Vase*

ALEXANDER SILVERMANN *vs.* UNITED STATES

Original Paintings in Mineral: Paragraph 1807, Tariff Act of 1930.

Where the collector classified four decorated glass vases as works of art not specially provided for under paragraph 1547, Tariff Act of 1930, and the evidence introduced at the trial establishes that they were not imported for any utilitarian purpose but have been used solely as exhibition pieces, that two of the vases are valued chiefly as original paintings in mineral, signed by the artist who produced them, and the other two are also signed pieces decorated by engravings, *held*, the two painted vases are entitled to free entry as original paintings in mineral under paragraph 1807 of the same act, but the weight of the evidence fails to sustain plaintiff's burden of proof that the other two are original engravings or sculptures as those terms are limited in paragraph 1807 and construed by the courts.

The original decorations by Goupy were interpreted by the Court as original paintings in mineral, signed by the artist, and a refund of duty was allowed. The original engraving by Gallé and the original deep etching by Daum were held subject to duty.

* T. D. 46532.

HILDA E. VOLLKOMMER, CERAMIC ARTIST

The studio of Hilda Vollkommer, Designers, of Pittsburgh, Pa., has moved permanently to 894 Sausalito Blvd., Sausalito, California, an artist colony across the bay from San Francisco. All work of a creative nature in the glass and ceramic fields will be handled as heretofore.

MAYOR LA GUARDIA ON RESEARCH*

The election of Mayor La Guardia as mayor of New York City gives interest to his record in support of scientific research. As a member of the seventy-second Congress, speaking on December 28, 1932, in opposition to an attempt to eliminate an item of approximately $39,000 from the agricultural appropriation bill, he said in part:

Mr. Chairman: Science knows no politics. Are we in this frenzy of economy, brought about by those who control the wealth of this country, seeking to put a barrier on science and research for the paltry sum of $39,113 out of an appropriation of $100,000,000? Science will go on when existing political parties will long have been forgotten.

I am sorry that the distinguished leader of the Republican Party in the House states that he is not versed in botany and publicly admits that he does not know anything of these terms or what it is all about; but Mr. Chairman, it is indeed a sad day for the people of this country when we must close the doors of the laboratories doing research work for the people of the United States. The gentleman from New York says it is all foolish.

Yes; it was foolish when Burbank was experimenting with wild cactus. It was foolish when the Wright boys went down to Kitty Hawk and had a contraption there that they were going to fly like birds. It was foolish when Robert Fulton tried to put a boiler into a sail boat and steam it up the Hudson. It was foolish when one of my ancestors thought the world was round and discovered this country so that the gentleman from New York could become a Congressman. (Laughter.) . . . Do not seek to stop progress; do not seek to put the hand of politics on these scientific men who are doing a great work. As the gentleman from Texas points out, it is not the discharge of these particular employees that is at stake, it is all the work of investigation, of research, of experimentation that has been going on for years that will be stopped and lost.

The next day, when another item in the same bill was under consideration and the point was made that research in agriculture might well be curtailed because of current overproduction, Mayor La Guardia said further:

I want to say to my colleague, the gentleman from New York, that I believe he is confusing the purpose of experimentation and research work of this kind with the immediate question of production. Surely we can not delay scientific research until the time comes when this country will need greater production. That indeed would be lack of vision. The very purpose of this kind of investigation and study is to have the information complete and ready when it is wanted, for it can not be developed overnight. . . .

Momentary overproduction is not the important question. The important question is the continuing of study to correct the defects of nature. The most fascinating part of human activity is its constant combat with nature in fighting the elements and in correcting the defects of nature. This has engaged the attention of mankind from the earliest times of which we have record. Assuming, if you please, that we now have overproduction and production of more commodities than the people of the country have ability to purchase, that is no justification for closing the doors of these laboratories, closing the doors to scientific research and stopping it. We must continue it. The population is constantly increasing. Some day the legislative branch of government will keep abreast of science. Why, Mr. Chairman, the most humble research scientist in the Department of Agriculture is at this time contributing more to his country than the most useful Member of Congress. The most humble engineer in the General Electric Laboratory or the Radio Corporation of American Laboratory is more useful to humanity than the most brilliant orator of this House. The trouble is that the legislative branch of government has not kept abreast with science. Government has lagged, science has advanced. We have permitted an unbalanced system of distribution to continue while science has increased production. We are living in the paradoxical state where there is great overproduction on the one hand and want and misery on the other. This is not the fault of science. This is the fault of government. This is the fault of men who have control of the governmental affairs of the country.

I want to plead with my colleague, the gentleman from New York (Mr. Taber), in his eagerness—and he is sincere and works hard on these bills—not to be too hasty in cutting down these appropriations to continue this scientific work, so that when the time does come we will have the information available. I repeat, if the science of government had only advanced along with the progress made in electricity, chemistry, mechanics, transportation, and agriculture, we should not today find ourselves in the midst of a ruinous financial crisis. While science and the arts and mechanics were progressing, government was struggling along with laws and economics founded on principles accepted centuries ago. Today we are still endeavoring to struggle along under construction and limitations of a constitution drafted and accepted at a time when steam had not yet been applied, before the railroads, before the telegraph, when electricity was entirely unknown, and in the days of hand production. Yes, gentlemen, science has forged ahead, and nothing that ignorance, petty politics, lack of vision, or hope to continue the old system may try to do can stop the onward march of science. So let not Congress seek to mitigate its shortcomings by attempting to adjust the universe with its own snail-like pace.

* From *Science*, December, 1933.

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CERAMIC COLOR & CHEMICAL MFG. CO.
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FINEST POTTERY CLAYS

BUYERS' GUIDE

A

Abrasives (Alundum-Crystolon)
Norton Co.

Aloxite (Refractory Products)
Carborundum Co.

Alumina (Hydrate and Calcined)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Pennsylvania Salt Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Aluminum Oxide (Fused)
The Exolon Co.
The Vitro Mfg. Co.

Alundum (Refractory Products)
Norton Co.

Ammonium Bifluoride
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Ammonium Carbonate
Ceramic Color & Chemical Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Antimony Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

B

Ball Mills
McDanel Refractory Porcelain Co.

Ball Mills (Laboratory Type)
Ceramic Color & Chemical Mfg. Co.

Barium Carbonate
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Batts
Carborundum Co. (*"Carbofrax Aloxite"*)
Norton Co. (*Alundum Crystolon*)

Bitstone
Potters Supply Co.

Blocks (Refractory)
Carborundum Co.
Norton Co.

Borax
American Potash & Chemical Co.
Drakenfeld & Co., B. F.
Pacific Coast Borax Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Borax Glass
Pacific Coast Borax Co.

Boric Acid (Anhydrous)
Pacific Coast Borax Co.
The Vitro Mfg. Co.

Boric Acid (Crystal, Granular, or Powder)
American Potash & Chemical Co.
Drakenfeld & Co., B. F.
Pacific Coast Borax Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Bricks (Refractory)
Carborundum Co. (*"Carbofrax Aloxite"*)
Norton Co.

C

Carbofrax (Refractory Products)
Carborundum Co.

Carbolon (Refractory Products)
The Exolon Co.

Carbonates (Barium, Lead)
Ceramic Color & Chemical Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Caustic Soda
Ceramic Color & Chemical Mfg. Co.
Pennsylvania Salt Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Cements
Carborundum Co.

Ceramic Chemicals
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Metal & Thermit Corp.
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Chromium Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Clay (Ball)
Ceramic Color & Chemical Mfg. Co.
Hammill & Gillespie, Inc.
Kentucky-Tennessee Clay Co.
Paper Makers Importing Co.
Potters Supply Co.
The Roessler & Hasslacher Chemical Co.
Spinks Clay Co., H. C.
The Vitro Mfg. Co.

Clay (China)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Edgar Brothers Co.
Hammill & Gillespie, Inc.
Paper Makers Importing Co.
The Vitro Mfg. Co.

Clay (Electrical, Porcelain)
Ceramic Color & Chemical Mfg. Co.
Edgar Brothers Co.
Kentucky-Tennessee Clay Co.
Paper Makers Importing Co.
Spinks Clay Co., H. C.
The Vitro Mfg. Co.

Clay (Enamel)
Ceramic Color & Chemical Mfg. Co.
Edgar Brothers Co.
Kentucky-Tennessee Clay Co.
Metal & Thermit Corp.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Clay (Fire)
Edgar Brothers Co.
Kentucky-Tennessee Clay Co.
Paper Makers Importing Co.
Potters Supply Co.

Clay (German Vallendar)
Ferro Enamel Corp.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Clay Miners
Edgar Brothers Co.
Kentucky-Tennessee Clay Co.
Paper Makers Importing Co.
Spinks Clay Co., H. C.

Clay (Potters)
Paper Makers Importing Co.
Spinks Clay Co., H. C.

Clay (Sagger)
Edgar Brothers Co.
Kentucky-Tennessee Clay Co.
Paper Makers Importing Co.
Potters Supply Co.
Spinks Clay Co., H. C.

Clay (Wad)
Kentucky-Tennessee Clay Co.
Potters Supply Co.
Spinks Clay Co., H. C.

Clay (Wall Tile)
Kentucky-Tennessee Clay Co.
Paper Makers Importing Co.
Spinks Clay Co., H. C.

Clocks (Gauge Board)
Ferro Enamel Corp.

Cobalt Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Colors
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Cornwall Stone
Hammill & Gillespie, Inc.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Cornwall Stone (Imported)
The Roessler & Hasslacher Chemical Co.

Crucibles (Filter, Melting, Ignition)
Norton Co.
Potters Supply Co.

Crystolon (Refractory Products)
Norton Co.

D

Decorating Supplies
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Drying Machinery
Ferro Enamel Corp.

E

Electrical Porcelain
Paper Makers Importing Co.

Enameling Equipment (Complete)
Chicago Vitreous Enamel Products Co.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.

Enameling Furnaces
Carborundum Co. (*Carboradiant*)
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
Norton Co.
Porcelain Enamel & Mfg. Co.

Enameling Iron (Sheet)
American Rolling Mill Co.

Enameling Muffles
Carborundum Co. (*Carbofrax*)
Norton Co. (*Alundum*)

Enameling (Practical Service)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.
The Vitro Mfg. Co
Titanium Alloy Mfg. Co.

Enamels
Ceramic Color & Chemical Mfg. Co.
Metal & Thermit Corp.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Enamels (Porcelain)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
Metal & Thermit Corp.
Porcelain Enamel & Mfg. Co.
The Vitro Mfg. Co.
Titanium Alloy Mfg. Co.

Equipment (Porcelain Enameling)
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.

Exolon (Refractory Products)
The Exolon Co.

BUYERS' GUIDE (continued)

F

Feldspar
Ceramic Color & Chemical Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Fire Brick
Carborundum Co.
Norton Co.

Flint
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Flint Pebbles
Ferro Enamel Corp.

Floors (Non-Slip)
Norton Co.

French Flint
Paper Makers Importing Co.

Frit
Ceramic Color & Chemical Mfg. Co.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.
The Vitro Mfg. Co.
Titanium Alloy Mfg. Co.

Furnace
Carborundum Co. (*Carboradiant*)
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.

G

Glaze and Body Spar
Ceramic Color & Chemical Mfg. Co.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Glazes and Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld & Co., B. F.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.
Titanium Alloy Mfg. Co.

Glaze Spar
Ceramic Color & Chemical Mfg. Co.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Gold
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Grinding Wheels
Norton Co. (*Alundum Crystolon*)

H

Hearths
Carborundum Co.
(*Carbofrax* heat treating)
Norton Co. (*Crystolon*)

Hearths (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Norton Co.

I

Iron (Enameling)
American Rolling Mill Co.

K

Kaolin
Ceramic Color & Chemical Mfg. Co.
Edgar Brothers Co.
Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Kilns (China, Decorating)
Drakenfeld & Co., B. F.

Kryolith
Pennsylvania Salt Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

L

Leeds (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.

Linings (Furnace Refractory, Block Refractory Plate, Brick and Tile)
Carborundum Co.
Norton Co.

M

Magnesia (Sintered, Calcined)
The Exolon Co.
Norton Co.

Magnesite
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Manganese
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Metals (Porcelain Enameling)
American Rolling Mill Co.

Minerals
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Muffles (Furnace)
Ferro Enamel Corp.
Carborundum Co. (*Carbofrax*)
Norton Co.

Mullite (Artificial)
The Exolon Co.

Muriatic Acid
Pennsylvania Salt Mfg. Co.

N

Nitrates (Cobalt, Sodium)
Ceramic Color & Chemical Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

O

Opacifiers
Ceramic Color & Chemical Mfg. Co.
Metal & Thermit Corp.
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
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Oxides
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Ferro Enamel Corp.
Metal & Thermit Corp.
Pennsylvania Salt Mfg. Co.
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
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P

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Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.
The Vitro Mfg. Co.
Titanium Alloy Mfg. Co.

Porcelain Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.
The Vitro Mfg. Co.

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The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Pyrometer Tubes (Refractory and Hard Porcelain)
McDanel Refractory Porcelain Co.

R

Refractories
Carborundum Co.
The Exolon Co.
Norton Co.

Refractory Materials
Carborundum Co.
The Exolon Co.
Norton Co.
Titanium Alloy Mfg. Co.

Rutile
Ceramic Color & Chemical Mfg. Co.
Metal & Thermit Corp.
The Roessler & Hasslacher Chemical Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

S

Saggers
Carborundum Co.
Norton Co.
Potters Supply Co.

Selenite of Sodium
Drakenfeld & Co., B. F.
The Vitro Mfg. Co.

Selenium
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Sheets (Enameling Iron)
American Rolling Mill Co.

Silica (Fused)
The Exolon Co.

Silicate of Soda
Ceramic Color & Chemical Mfg. Co.
Philadelphia Quartz Co.
The Vitro Mfg. Co.

Silicon Carbide
The Exolon Co.
Norton Co.

Silicon Carbide Firesand
The Exolon Co.

Sillimanite (Synthetic)
The Exolon Co.

Slabs (Furnace)
Carborundum Co.
Norton Co.

Smelters
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.

Soda Ash
Ceramic Color & Chemical Mfg. Co.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Sodium Antimonate
Ceramic Color & Chemical Mfg. Co.
Metal & Thermit Corp.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Sodium Fluoride
The Roessler & Hasslacher Chemical Co.
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Spar
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Paper Makers Importing Co.
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The Vitro Mfg. Co.

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Potters Supply Co.

Stilts
Potters Supply Co.

Sulphuric Acid
Drakenfeld & Co., B. F.
Pennsylvania Salt Mfg. Co.

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T

Talc
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Paper Makers Importing Co.
The Roessler & Hasslacher Chemical Co.

Tanks (Pickle)
Ferro Enamel Corp.

Tile (Refractory)
Carborundum Co. (*Carbofrax*)
Norton Co.

Tile (Wall)
Ferro Enamel Corp.
Paper Makers Importing Co.

Tin Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Metal & Thermit Corp.
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co.

Titanium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co. B. F.
The Vitro Mfg. Co.
Titanium Alloy Mfg. Co.

Titanium Oxide
The Roessler & Hasslacher Chemical Co.
The Vitro Mfg. Co
Titanium Alloy Mfg. Co

Tubes (Insulating)
McDanel Refractory Porcelain Co.
Norton Co.

Tubes (Pyrometer)
McDanel Refractory Porcelain Co.
Norton Co.

W

Wet Enamel
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Ferro Enamel Corp.
Porcelain Enamel & Mfg. Co.
The Vitro Mfg. Co.

Whiting
Drakenfeld & Co., B. F.
The Roessler & Hasslacher Chemical Co.

Z

Zirconia
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Titanium Alloy Mfg. Co.
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Week of February 11, 1934

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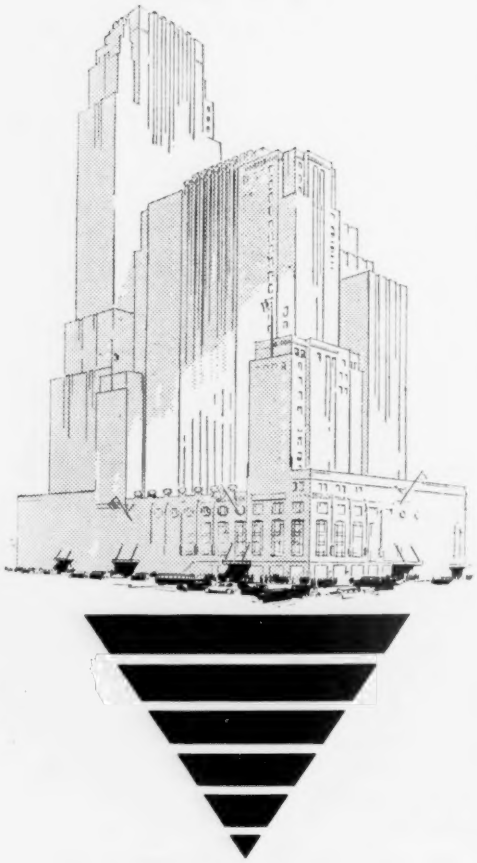
SUNDAY NIGHT—Concert and President's reception.



MONDAY FORENOON and AFTERNOON—General sessions devoted to ceramic design.
MONDAY EVENING—Keramos convocation.
MONDAY NIGHT—9 P.M. Ceramic Ruckus.
TUESDAY and WEDNESDAY—Division meetings.
TUESDAY NOON—General luncheon.
TUESDAY NIGHT—Edward Orton, Jr., Memorial lecture, by Dr. A. L. Day.
WEDNESDAY NOON—Division luncheons.
WEDNESDAY AFTERNOON — 6 P.M. Fellows Meeting.
THURSDAY FORENOON—General session on Thermal Conductivity.
THURSDAY ALL DAY—Enamel Division trip to Armco and Frigidaire.
THURSDAY AFTERNOON—Tour to points of interest in Cincinnati.
THURSDAY NIGHT—Lecture by Dr. Geo. Morey—"Glass, the Bond in Ceramics."
FRIDAY ALL DAY—GRAND EXCURSION TO LOUISVILLE.

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